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Profit shifting of multinational enterprises: evidence from Finland

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Marika Viertola
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School of Business

Aalto University, P.O. BOX 11000, 00076 AALTO
www.aalto.fi

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Author Marika Viertola

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Abstract

This thesis studies whether Finnish multinational enterprises react to the tax incentives generated by corporate income tax rate differences and shift their profits to low tax countries. The profit shifting of Finnish multinational enterprises is estimated by exploiting an affiliate level panel data set for years 2012-2017. This panel data contains detailed information about the ownership as well as accounting information of subsidiaries that have a Finland-based ultimate owner. Applying an estimation method introduced also in previous literature, called Hines-Rice approach, and adjusting it to a fixed effects model results in statistically significant tax semi-elasticity estimates between -2.1 to -2.9. These imply that a 10-percentage point tax rate increase in affiliate's home country is related to decreased reported profit before taxation of 21-29% by an affiliate located in that country. The results are confirmed by several robustness checks that all provide similar conclusions. This suggests that Finnish multinational enterprises react to tax rate differences through shifting profits. Additionally, results suggest that debt-shifting channel accounts for about one-fifth of total profit shifting. These results confirm results of previous studies and are in line with the theory of profit shifting.

Keywords profit shifting, corporate taxation, multinational enterprises

Aalto-yliopisto
Kauppakorkeakoulu

Aalto-yliopisto, PL 11000, 00076 AALTO
www.aalto.fi

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Tiivistelmä

Tutkielma tarkastelee kuinka suomalaiset monikansalliset yritykset reagoivat tuloverotusasteissa olevien erojen synnyttämiin verokannustimiin ja tästä johtuen siirtävät voittojaan alhaisen verotuksen maihin. Suomalaisten yritysten voitonsiirtoja tutkitaan käyttämällä yrityskohtaista paneeliaineistoa, joka sisältää havaintoja yrityksistä vuosilta 2012-2017. Paneeliaineisto käsittää yksityiskohtaista tietoa omistajarakenteesta sekä tilinpäätöstietoja ulkomaisista tytäryhtiöistä, joilla on suomalainen emoyhtiö. Tutkimus käyttää aiemmassa kirjallisuudessa esiteltyä mallia, nimeltään Hines-Rice malli, ja soveltaa mallia kiinteiden vaikutusten mallin viitekehykseen. Tutkimuksessa estimoidut tilastollisesti merkitsevät veropuolijoustot vaihtelevat -2.1 ja -2.9 välillä. Nämä estimaatit merkitsevät sitä, että 10 prosenttiyksikön veroasteenkorotus tytäryhtiön kotimaassa on yhteydessä 21-29% laskuun kyseisen tytäryhtiön raportoiduissa voitoissa ennen veroja. Tutkimuksessa esitellään useita vaihtoehtoisia regressiota, jotka vahvistavat tuloksia entisestään. Täten tulokset viittaavat suomalaisten monikansallisten yritysten reagoivan veroaste-eroihin siirtämällä voittojaan. Lisäksi tulokset ehdottavat velansiirtokanavan osuuden olevan noin viidesosa voitonsiirroista kokonaisuudessaan. Tutkimuksen tulokset ovat yhdenmukaisia sekä aikaisempien tutkimusten että voitonsiirtoteorian kanssa.

Avainsanat voitonsiirto, yritysverotus, monikansalliset yritykset

Profit shifting of multinational enterprises: evidence from Finland

Marika Viertola*

December 20, 2019

Abstract

This thesis studies whether Finnish multinational enterprises react to the tax incentives generated by corporate income tax rate differences and shift their profits to low tax countries. The profit shifting of Finnish multinational enterprises is estimated by exploiting an affiliate level panel data set for years 2012-2017. This panel data contains detailed information about the ownership as well as accounting information of subsidiaries that have a Finland-based ultimate owner. Applying an estimation method introduced also in previous literature, called Hines-Rice approach, and adjusting it to a fixed effects model results in statistically significant tax semi-elasticity estimates between -2.1 to -2.9. These imply that a 10 percentage point tax rate increase in affiliate's home country is related to decreased reported profit before taxation of 21-29% by an affiliate located in that country. The results are confirmed by several robustness checks that all provide similar conclusions. This suggests that Finnish multinational enterprises react to tax rate differences through shifting profits. Additionally, results suggest that debt-shifting channel accounts for about one-fifth of total profit shifting. These results confirm results of previous studies and are in line with the theory of profit shifting.

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1 Introduction

As the globalization keeps on evolving, issues related to international taxation are often matters of policy discussion. Devereux and Maffini (2007) highlight that the policymakers are often concerned on the impact that international capital flows may have on economic welfare and tax revenues of countries. There are many mechanisms through which tax policies may affect the behavior of companies. Relocation of foreign direct investment is a well-known channel through which companies may react to tax rate differentials between countries. The process of relocating investments and real activity is a legal process and may even be inevitable for some investments since the lower tax rates may make an investment profitable compared to an unprofitable investment in high-tax country.

This study aims to evaluate the scale of profit shifting of Finnish multinational enterprises. Profit shifting is another phenomenon caused by tax differentials between countries and tax policy changes. For example by Godar (2018) defines the term of profit shifting as multinational enterprises trying to minimize their overall global taxes by moving their profits from high-tax countries to low-tax countries. As noted by Beer et al. (2018), the process of reallocating profits done by multinationals in response to different tax rates of foreign countries with the intention to minimize the multinational's global tax liability is called tax avoidance. In addition, Huizinga and Laeven (2008) argue that if profit shifting efforts of a multinational enterprise are effective, this should reduce the enterprise's profits reported in high-tax countries. They also define multinational enterprise as a firm that has a parent located in home country for tax purposes and that has at least one of the subsidiaries located in a foreign country. Devereux and Maffini (2007) highlight the importance of multinational enterprises to the economies and argue that this is one reason for the increasing interest in studying their activities. These multinational enterprises[1] are especially important if the enterprises generate positive spillovers like technical efficiency that the local firms may replicate.

In addition to a growing amount of academic literature on profit shifting, the subject has been a recent topic in international tax policy discussion as well. The initiative on "base erosion and profit shifting" (BEPS) launched by Organization for Economic Cooperation and Development (OECD) and the US tax reform proposals are examples of the recent policy discussions related to profit shifting. The growing interest in profit shifting is partly because it has distinguished adverse effects. First, profit shifting reduces the worldwide tax revenue. The Action 11-2015 final report of the BEPS Project launched by OECD (2015) included an estimate of lost global cor-

[1]Multinational enterprises will from now on be noted as 'multinationals'

porate income tax (CIT) revenues between 4 per cent and 10 per cent of global CIT revenues. In addition to the globally decreased CIT revenues, high-tax countries lose tax revenues to low-tax countries. In other words, profit shifting causes reallocation of tax revenues between countries. Other taxpayers, for example individuals, may also suffer from profit shifting since a greater share of the tax burden will be on them (OECD, 2013). Clausing (2016) notes that the lost tax revenue due to profit shifting needs to be compensated either by taxing other sources more heavily, increasing the government budget deficit or by cutting the government expenses.

However, governments and other taxpayers are not the only ones harmed by profit shifting. Multinationals and other companies may be harmed by profit shifting activities. OECD (2013) argues that multinationals themselves could face reputational risk if the effective tax rate is seen to be too low and exposed for example in media. This risk is assessed differently by multinationals and thus, may have an uneven impact on different multinationals. Additionally, domestic firms may be also harmed by multinationals' profit shifting because of the competitive disadvantage the only locally operating firms face compared to multinationals as they are not able to reduce their tax liability by shifting their profits to low-tax countries (OECD, 2013).

In addition to the known adverse effects, also globalization and digitalization play a role in the growing interest of profit shifting. Huizinga and Laeven (2008) point out that the firms based in Europe are increasingly multinational due to the euro and the single free market in the EU. These generate various opportunities and incentives for the European based multinationals to practice profit reallocation since the European countries have significant tax rate differences. This argument is also relevant for Finnish multinationals, since Finland is part of the EU and has euro as its currency. Thus, there are incentives for multinationals based in Finland to exercise profit reallocation, either in or out of Finland. Additionally, Finland reduced its CIT rate from 24.5% to 20% in 2014. The tax rate change gives further motivation to study if the tax rate reduction has had implications on profit shifting of Finnish multinationals. The Action plan by OECD (2013) also emphasizes the digitalization point of view. As many digital products and services can be delivered entirely through the internet, companies can more easily operate in countries where they have no physical presence or operations. Many countries are unable to tax these businesses and one solution could be to revise the definition of permanent establishment. For example, in Finland, a foreign company must pay corporate income tax to the government if it has a permanent establishment in Finland. Currently, the definition of permanent establishment in Finland according

to the Finnish Tax Administration (2014b) is "a fixed place of business through which the company conducts some or all of its operations".

Heckemeyer and Overesch (2017) note that there is empirical evidence on profit shifting behavior of multinationals and the phenomenon is largely acknowledged. Clausing (2016) also argues that most of the observers see profit shifting as an increasing problem. However, the scale of profit shifting is not clear and is still under debate, hence there is no consensus over how big the phenomenon really is. Even though scale of profit shifting has not been established yet, the academic literature has identified many profit shifting channels. For example, Huizinga and Laeven (2008) identify the three main channels of profit shifting to be transfer mispricing, strategic location of management of intellectual property and debt shifting. These different techniques of shifting profits are discussed further in Chapter 2.2.

To contribute to the already extensive literature, I study the profit shifting behavior and the scale of this behavior of Finnish multinational firms. I begin by introducing briefly the current international tax system and the system that is in use in Finland. After that, I define profit shifting and introduce the effects as well as channels of it. I briefly discuss the role of tax havens as part of profit shifting in Chapter 2.3. Then, I discuss the theoretical framework of when and why it is profitable for the multinationals to shift profits. In Chapter 3 I introduce the standard approach called Hines-Rice approach and discuss some previous empirical literature on profit shifting. After the literature review, I present the data and methods used in this study in more detail. Finally, I show the results of the study on individual firm level, aggregated level and country level. I also provide additional regressions as robustness checks. In Chapter 6 I further discuss the results and their implications. The last chapter concludes.

2 Conceptual and theoretical framework

2.1 International taxation and Finland

Hines (1999) argues that international taxation affects the location as well as magnitude of foreign direct investment. In addition, Hines (1999) suggests that international taxation is partly responsible for tax avoidance activities executed by companies. As defined by Beer et al. (2018), shifting profits between countries to minimize overall taxes can be seen as tax avoidance. Thus, understanding the framework of international taxation is crucial to evaluate the impact of tax rates on the profit shifting actions carried out by the multinationals. Hines (1999) takes into consideration also the additional complexity international taxation has due to multiple tax collectors (governments) compared to domestic taxation.

According to Beer et al. (2018) the framework of multinationals' tax treatment is based to a large extent on separate accounting. This practice means that each subsidiary of a multinational operating in different countries is taxed on its individual level. Generally, country's right to tax a multinational depends on the source of the income as well as the residence of the corporate taxpayer. This division to residence and source based taxation originates from 1920s. Source is defined as the place where the investment and production take place as where residence refers to the place where the company receiving the income is located at. Taxing rights of active income, which is income generated by selling products or services, is generally owned by source countries. However, the permanent establishment definition and threshold affect whether the source country can tax the foreign company. Taxing rights of passive income, that is income from investments etc., then is retained by residence countries (Beer et al., 2018).

Beer et al. (2018) introduce the two alternative systems which define how the active income of multinationals generally are taxed. Territorial system provides source countries the taxing rights to active income so countries only tax the active income derived in its borders and residence countries exempt the foreign earnings. The territorial system is used for example in Europe and Japan. According to Hines (1999) almost all countries tax the active income generated within the country's borders, i.e. tax at least according to the territorial system. Beer et al. (2018) describe the alternative system, the worldwide system, as a system that grants the residence country rights to tax all active income of the multinational. This granted right means that countries under the worldwide system may also tax active income from other source countries, i.e. all active income generated including income generated outside the country's borders. Usually countries operate under either one

of the systems and the system in question then specifies the primary method used to tax foreign incomes. It should be noticed though that bilateral tax treaties between countries may require a different method than the country's primary methods are.

Double taxation may occur, as noted by Helminen (2013), in international situations when residence and source country principles are applied at the same time. In these situations the taxpayer would be obligated to pay taxes from the same income to several countries. Similarly, Hines (1999), argues that costs of double (or multiple) taxation are serious since applying multiple tax rates on the same income discourages most international business activities and may even eliminate some activities. Therefore, avoiding double taxation is extremely important in order to promote international business activities, but at the same time, these rules applied to avoid double taxation complicate the international taxation system even more. Simplest method for avoiding double taxation is the exemption method. Keen (1991) describes the exemption method as a case where the residence country does not apply any taxes to the foreign income sourced in another country. Thus, if a country applies the exemption method exclusively to all foreign income, the country is applying the territorial system, i.e. only taxing source based income of firms located in the country.

Foreign tax credit is permitted by the residence country in turn to avoid double taxation. These foreign tax credits may be used to offset the local residence country tax liabilities (Hines, 1999). Since almost all countries tax source based income, once countries also tax residence based the same income, the same income is taxed twice. Thus, countries need to apply the credit method to exempt the income from residence taxation. According to Helminen (2013) the tax carried out in another country is deducted from the payable tax in residence country. Hines (1999) provides an example of a tax credit situation: a US based company pays taxes to a foreign country 10 % of a 100 $ income. Because the CIT rate in the US is 35 %, the company must pay 25 $ of taxes to the US after the credit method.[2]

It should be noted that usually the credit method is restricted to the amount of tax that would be paid from the income in the residence country. Following the example before, if the foreign taxes paid would have been 45 % of the income, the available amount of credit would still have been 35 % of the income, i.e. 35 $. Hines (1999) notes these excess foreign tax credits as the share of the company's foreign tax payments that exceeds the residence country's payable taxes generated by the foreign incomes. Some countries may permit the company to use the excess foreign tax credits in the following years. Deficit foreign tax credits on the other

[2]The original tax liability of the company to the US would be 35 $, i.e. 35 % of the income, but according to the credit method the amount of foreign taxes paid, 10 $, is deducted.

hand are generated in situations where the foreign taxes paid are smaller than the tax liability of the foreign income in residence country, i.e. the example by Hines (1999) introduced previously. In these situations, the company needs to pay taxes also to the residence country under worldwide system. Hines (1999) also mentions the "worldwide averaging" -method, which complicates the calculation of the tax credit limit even further. In this method, a company has excess foreign tax credits if the total of worldwide foreign taxes paid of the income exceeds the amount that would be paid of the income in the residence country (Hines, 1999).

Beer et al. (2018) note that the division to the territorial and worldwide system is not straightforward: there are exceptions like deferrals and controlled foreign company (CFC) rules that soften the differences between the two systems. Huizinga and Laeven (2008) note that even though some countries tax the foreign incomes residence based, they also often provide deferrals of this taxation. According to Keen (1991) in the deferral method, the foreign income generated by the subsidiary is payable in residence country only when the income is repatriated to the parent in the residence country. The repatriation of foreign income can be done for example by returning dividends to the parent. Hines and Rice (1994) argue that the tax deferral method may generate incentives for the multinationals to delay the repatriation of the foreign income taxed only in a low-tax country. Also the CFC-rules give additional residence based taxation rights for territorial and worldwide systems (Beer et al., 2018).

The tax system in Finland is based on a worldwide system. In other words, Finnish companies must pay taxes on their income from Finnish sources as well as from foreign sources. The primary method in use to avoid double taxation in Finland is the credit method (Helminen, 2013). According to the guidance provided by Finnish Tax Administration (2019), the exemption method is only used when there is a bilateral tax treaty between Finland and another country requiring the use of exemption method. In cases where the exemption method is required by a tax treaty, the foreign sourced income will not be included in the company's total taxable income and no taxes of this income are paid to Finland. This exemption on the other hand also means that the company will not have rights to deduct any expenses or interest payments in Finland related to the production of this foreign income (Finnish Tax Administration, 2019).

The credit method in Finland works as described earlier. Income from foreign sources is taxed in Finland but tax paid abroad for the income is deducted from the tax liability in Finland. In other words, the tax paid abroad is credited from tax paid to Finland. It should be noticed that according to Finnish tax Administration (2019), the maximum available credit is restricted to the amount of tax that would

be paid from the income in Finland. Foreign tax may exceed the maximum credit in situations when the foreign country has a higher tax rate, or the taxpayer has less taxable income in Finland compared to taxable income abroad. The unused credit, excess foreign tax credit, can be used in the following five years for the same foreign income type or foreign income source (Finnish Tax Administration, 2019).

In addition to the methods used to avoid the double taxation of Finnish companies operating abroad, the permanent establishment definition in Finland is important for foreign multinationals operating in Finland. As noted by Helminen (2013), if a foreign company has a permanent establishment in Finland, the company is obligated to pay tax to Finland on income generated from that permanent establishment. The definition of the permanent establishment is critical, since it defines whether or not Finland has the right to tax the foreign company. As discussed earlier, the general rule of permanent establishment in Finland according to the Finnish Tax Administration (2018a) is a "fixed place of business, through which the business of an enterprise is wholly or partly carried on".[3] In addition to the income generated from the PE, it may also receive income sourced in other countries. Finnish tax authorities use the arm's length principle[4] in order to define what income is attributable for the permanent establishment and thus, taxable in Finland (Finnish Tax Administration, 2018a).

Finally, the corporate income tax (CIT) rate of Finland and how it positions relative to other countries is important to firms operating in Finland as well as the government of Finland. Figure 1 presents some recent evolution of CIT rates to inform the reader where Finland positions. Tax rates of Finland and Sweden as well as the average tax rates within EU and tax haven countries are presented in the figure by exploiting the data on CIT rates provided by KPMG (n.d.). Additionally, tax havens are divided to all tax havens and to the Big-7 countries, which are introduced in more detail in Chapter 2.3. We can notice that in the beginning of the time period in question, year 2004, Finland had the highest tax rate of those presented in the figure. Interestingly, by 2019 the tax rate of Finland is below the tax rate of Sweden as well as below the EU average tax rate. Most outstanding decrease of Finnish CIT rate was in 2014 once the tax rate was dropped from 24.5% to 20%.

As Sweden is an important trading partner to Finland, the relation between Finnish and Swedish CIT rates is shown in Figure 1. Interestingly, the tax rates of these neighboring countries experience similar kind of evolution within the time

[3]For the exclusive definition of the PE in Finland, please see the official instruction by Finnish Tax Administration (2018a).

[4]Definition for the term "arm's length principle" can be found in the glossary.

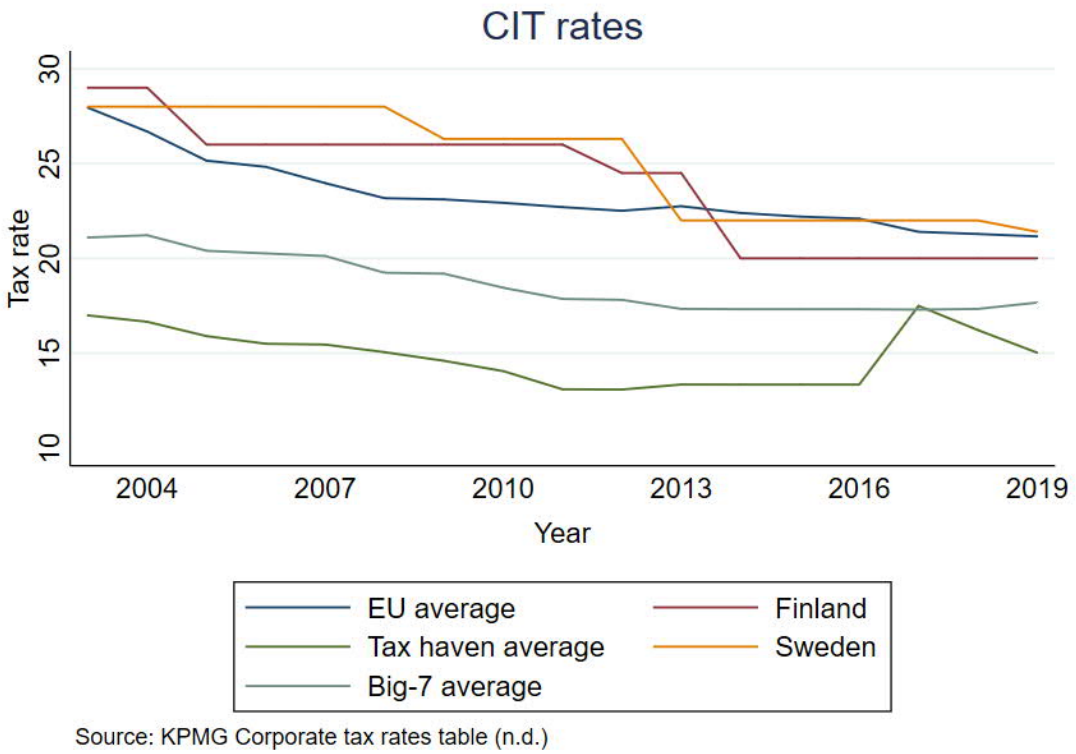

Figure 1: Statutory corporate income tax (CIT) rates

period. It seems like Finland and Sweden have lowered their CIT rates in turns. This relationship may imply the existence of tax competition between these countries. I discuss tax competition and the implications it has on profit shifting in the next chapter. Lastly, Figure 1 shows the CIT rates in tax haven countries. Comparing the average of all havens to the Big-7 havens, we can in turn see that including small havens in the grouping lowers the average CIT rate substantially. Anyhow, the average CIT rates of both haven groupings are well below the other CIT trends. Figure 1 though suggests that the difference in CIT rates may not be that large anymore in 2019 as it was in 2004.

2.2 Profit shifting: channels and effects

Now that I have introduced briefly the basics of the international tax system, I move on to the effects that international taxation has on companies. According to Hines (1999) international tax rules and other countries' tax laws affect corporate behavior. The most direct response by multinationals is to reallocate and adjust the scope of foreign direct investment in order to minimize the multinational's tax liabilities. However, this is not the only reaction in response to global tax rate differences as they also generate incentives to multinationals to shift their profits.

The reallocation of profits is an important part of tax avoidance and it has many adverse effects. In this chapter, I further define profit shifting, the various techniques of it and the adverse effects it has.

For example, Hines (1999) defines tax avoidance as reallocating taxable income from high tax rate countries to low tax rate countries. He also argues that tax avoidance can include the activity of changing income recognition timing for tax purposes. Beer et al. (2018) in turn categorize tax avoidance into two types: avoidance of source country taxation and avoidance of residence country taxation. Since profit shifting is the main tool for source country avoidance, I study the source country tax avoidance in more detail here. Beer et al. (2018) identify various techniques which the multinationals may use to shift profits between subsidiaries in different countries and this way minimize their overall tax liability. Important issue to notice here is that these techniques may be entirely legal, thus they are referred to as tax avoidance. Illegal techniques or use of legal techniques in an illegal way on the other hand are called tax evasion (Beer et al., 2018). Additionally, it should also be noticed that profit shifting can occur either between a parent and its foreign affiliate or between two affiliates located in different countries (Huizinga and Laeven, 2008).

Transfer pricing (or more accurately transfer mispricing) is one of the most common techniques used by multinationals to shift profits. Cristea and Nguyen (2016) define transfer pricing as inter-company pricing of tangible and intangible goods. According to Cristea and Nguyen (2016) and Beer et al. (2018) multinationals can use transfer pricing as a tool by under-pricing exports from high tax countries to low tax countries or by overpricing the inputs from low tax countries to high tax countries. This way multinationals can impact the allocation of their tax base between countries to reduce their total global tax liability. Most countries use the arm's length principle in assessing inter-company pricing. Arm's length pricing refers to the practice where internal prices should replicate the prices to a third independent party. The problem may be that all transactions do not have an arm's length price if there are no comparable transactions to third parties. De Mooij (2005) notes that for intangibles, like brand names or intellectual property rights, the determination of an arm's length price is especially difficult. He also argues that the problem is likely to become even more relevant since the share and importance of intangible products is growing.

In addition to transfer pricing, debt-shifting is a commonly used technique by the multinationals to shift profits. According to Cristea and Nguyen (2016) multinationals can benefit by financing high tax located subsidiaries with lending from subsidiaries located in low tax countries and then deducting the interest payments in high tax countries. The interests on loans need to be tax deductible for the

multinational to use debt-shifting to shift profits. De Mooij (2005) notes that in order to minimize the tax liability of a multinational, parent company will prefer to finance low tax country affiliates with equity and high tax country affiliates with lending. The repatriated dividends are generally taxed in the country where the equity financed affiliate is located. Thus, it is optimal to finance these affiliates with equity. Beer et al. (2018) also define locating the external borrowing in high tax countries as debt-shifting. Additionally, they point out that this debt-shifting reduces the multinationals tax bill and does not affect the total exposure to debt of the group.

Transfer pricing and debt shifting are the main techniques of multinationals' shifting profits from high tax countries to low tax countries. In addition to these two, Beer et al. (2018) name two techniques which multinationals may use to avoid source country taxation. These are the strategic location of intellectual property as well as tax treaty shopping. By moving valuable intellectual properties to subsidiaries located in low tax countries, the income generated by the patent is taxed with a lower tax rate. This kind of reallocation is usually done before the intangible has fully developed and the tax authorities cannot determine the true value of it. Additionally, there is often no third party transactions that could be compared to this and thus, determining the arm's length price for multinational's intangible inter-company sales is often very difficult and gives an excellent opportunity to exercise transfer mispricing. By tax treaty shopping, Beer et al. (2018) refer to the practice of linking different bilateral tax treaties and alter the multinational's cross-border payments through the country that has the lowest withholding taxes. This way the multinational can reduce its liability of withholding taxes. Lastly, multinationals may avoid source country taxation by avoiding the permanent establishment (PE) status in the first place. If the affiliate has no PE status in the country, the country is unable to source-base tax it.

According to Beer et al. (2018) where as worldwide systems may stop the avoidance of source country taxes at least to some extent, residence taxation can still be avoided. They identify two main channels of residence country taxation avoidance: using tax deferrals and locating the headquarters in a country of territorial system. Tax deferral refers to the process of retaining the foreign profits abroad and not repatriating the profits home. Since the worldwide system imposes residence taxes only on repatriated profits, multinationals can avoid taxes by simply not repatriating the foreign profits. On the other hand, by locating the multinational's headquarters to a country with a territorial system, multinationals can also avoid repatriation taxes. The process of changing the residence of multinational is also called corporate inversion (Beer et al., 2018).

As highlighted by Dharmapala (2014), the reason why the problem of profit shifting exists is because of the inconsistencies between tax rates and laws of different countries. Altogether, these give incentives for multinationals to participate in profit shifting activities. If the tax rate differences create incentives for profit shifting, you might consider a uniform global tax rate as a solution to the problem. This might sound rational at first since as discussed earlier, OECD (2015) provided an estimate of the globally lost revenues to be about 4-10 % of the total CIT revenues. Though it might seem like an uniform global tax rate would solve the issue of lost global CIT revenues, uniform tax rate is not in the favor of all governments. Noted for example by Overesch and Rincke (2011), tax competition between countries exist. Goal of tax competition is to attract paper profits of multinationals. Countries find it especially optimal to lower corporate tax rates if other countries have also cut their tax rates as was seen between Finland and Sweden in Figure 1. I will derive the theory implication behind this tax competition behavior of countries in the next chapter.

In addition to why profit shifting is a problem, another fundamental question raised by Dharmapala (2014) is for whom profit shifting constitutes as a problem. In Chapter 1 I shortly introduce these adverse effects of profit shifting and will now review them in more detail. Missing global tax revenues is one of the adverse effects of profit shifting. Huizinga and Laeven (2008) also introduce the effects profit shifting has on the redistribution of tax revenues: tax revenues from high tax countries are lost to low tax countries. Findings by Tørsløv et al. (2018) suggest that the European Union non-tax haven countries are the ones suffering most due to profit shifting. These two effects, lost global tax revenues and the redistribution of tax revenues, are the effects that profit shifting has on countries. Additionally, also other taxpayers, like individuals, may suffer from profit shifting as they will have to carry greater tax burdens (OECD, 2013). Dharmapala (2014) notes though that the impact on other taxpayers does depend on the incidence of the corporate tax and therefore is not straightforward. However, as argued by Clausing (2016) the lost tax revenues need to be compensated somehow. If not by taxing other sources more heavily, then by increasing the government deficit or by cutting down government expenses.

The OECD (2013) report implies that companies themselves are also victims of profit shifting. Local companies suffer from a disadvantage compared to the multinationals. Because these purely domestic firms cannot shift their profits, they have larger tax burdens compared to multinationals (OECD, 2013). Profit shifting hence distorts the competition and provides a head start for multinationals. Nevertheless, profit shifting behavior can also harm the multinationals because of the potential

reputational costs it may generate. Reputational costs refers to the possible costs caused by for example the lost sales due to clients shifting their purchases to another firm not participating in profit shifting. According to the report by OECD (2013), this risk can generate competitive disadvantage to some multinationals, because of the reputational risk being evaluated differently by different multinationals. Dharmapala (2014) challenges this by arguing that multinationals should be able to include these reputational costs in the private costs of tax planning. In other words, the multinational should take the reputational costs into consideration once assessing whether or not to practice profit shifting.

Reputational costs are not the only costs of profit shifting that multinationals need to take into account once considering profit shifting activities. Saunders-Scott (2015) reports that recently there has been policy changes affecting the cost of shifting profits. Many of these policy changes have been aimed to increase the costs of transfer pricing. As noted by Saunders-Scott (2015), many countries have increased the requirements of transfer pricing documentations and also have increased the resources for monitoring the transfer prices used by multinationals. The requirements of transfer pricing documentation were also tightened in Finland in 2017 (Finnish Tax Administration, 2018b). Furthermore, policy changes aimed at preventing debt-shifting have also been established by governments. Rules on debt arrangements occurring only at "arm's length" and limits to interest deduction are examples Saunders-Scott (2015) gives on policy changes related to the costs of debt-shifting. In Chapter 2.4, I will relate the costs of profit shifting to the theory of why shifting profits is an optimal behavior for multinationals.

2.3 Tax havens

To study the impacts of tax rate changes on the behavior of companies, it is helpful to determine and understand what makes a country become a tax haven, as tax havens play a major role in the practice of profit shifting. For example, the estimate provided by Clausing (2016) suggests that 82% of the US multinational profit shifting are directed to only seven tax haven countries. Tørsløv et al. (2018) on the other hand estimate that 40% of multinational profits were shifted to tax haven countries in 2015. These estimates indicate the importance of tax havens in multinational profit shifting activities.

The process of defining the term tax haven is not straightforward: Keen and Konrad (2013) point out that the term is widely used but does not have any agreed definition in the practical world of policy. Most intuitive characteristic of a tax haven is a low (or even a zero) tax rate. Low taxation by itself may not be enough: for

example, resource-rich countries might have lower tax rates since they just simply may not need as high tax rates as other countries. In addition to low tax rates, the term tax haven usually implies that the country attracts paper economic activity more than real economic activity. Third important factor of tax havens identified by Keen and Konrad (2013) is that tax haven jurisdictions encourage tax avoidance or at least these jurisdictions do not discourage tax avoidance and/or evasion strongly enough. In practice, this means that the jurisdictions provide restrictions, like secrecy laws, that prevent sharing information and consequently undermine tax revenues of other non-haven countries (Keen and Konrad, 2013).

The Kanbur-Keen model, that I will discuss in detail in Chapter 2.4.2, predicts that generally small countries are more likely to become tax havens. This fact results from the model's conclusion that small countries benefit more from undercutting tax rates, as compared to large countries that suffer a lot more from the decrease in tax rate (Keen and Konrad, 2013). Slemrod and Wilson (2009) use a set of 35 countries named by OECD as "non-cooperating tax havens". These 35 countries form 15% of the world's countries in total. In contrast, the total population of the designated countries is only 0.15% of the total world's population, and the average population is 284,000 (Slemrod and Wilson, 2009). These further confirm the argument of small countries becoming more likely tax havens.

Hines and Rice (1994) in turn identify 41 countries and territories as tax haven locations. The same set of countries has been used for example by Dharmapala and Hines (2009) who compare this set of tax haven countries to other countries (i.e. non-haven countries). They find that relative to non-havens, tax havens are small, usually countries with population under one million, and are more likely to be islands. Additionally, the study finds that a better-governed country is more likely to turn into a tax haven country (Dharmapala and Hines, 2009).

Table 1 describes characteristics of the tax haven countries included in the sample of this study. The table is produced by replicating Hines and Rice (1994) using the data sample used also later in this study.[5] Hines and Rice (1994) separate the relatively large tax havens from others. These seven countries, called Big-7, are Hong Kong, Ireland, Liberia, Lebanon, Panama, Singapore and Switzerland. Each of these has a population of over one million inhabitants and all together they account for 80 percent of total tax haven population and 89 percent of total tax haven GDP. With the data from U.S. Department of Commerce for year 1982, Hines and Rice (1994) find that all tax havens (without Big-7) account for 1.2 (0.3) percent of world population and 3.0 (0.3) percent of world GDP. Thus, the share that all tax havens have of world GDP is over twice as large compared to the population share.

[5]For more information on the data in use see Chapter 4.1.

Table 1: Tax havens as part of the study

	Share of Finnish MNE's operations abroad (percent of total sample)				
	Number of affiliates	**Profit before taxation**	**Number of employees**	**Costs of employees**	**Total assets**
Tax havens:					
Big havens	0.5	2.9	0.3	0.4	7.3
All havens	0.6	4.2	0.4	0.7	7.5
EU member states:					
EU	75.2	71.3	70.6	87.7	83.8
Excl. Sweden	57.8	36.8	50	60.3	26.7
Developing countries:					
2018 listing	20.7	23.3	29.5	6.2	12
2012 listing	26.8	24.2	32.6	6.7	12.6

The sample of this study includes two of these Big-7 tax havens: Ireland and Singapore. On the other hand, Luxembourg is a small tax haven that has affiliates included in the sample and thus, Luxembourg is included in the all havens group. The share of tax haven affiliates may result from a data restriction discussed further in Chapter 4.3. For comparison, also shares for EU and developing countries are provided in Table 1.[6] Shares for EU are also provided without Sweden as Sweden accounts for a substantial amount of Finnish multinational operations.

Even though the share of tax haven affiliates is very small in the sample, we can derive some observations from Table 1. An interesting observation is that the share of assets in all tax haven affiliates is almost 12.5-times larger compared to the share of affiliates in tax havens. The profit share of all tax havens is 7-times the share of sample affiliates in tax haven countries. Additionally, all comparison groups (except developing countries according to 2018 listing) have a smaller profit share than the share of sample affiliates, indicating the potential of tax havens functioning as profit shifting destinations. Another indication of relatively low physical presence in the tax haven countries is the low share of employment. Also Hines and Rice (1994) find similar results.

[6]The countries of each group are specified in Appendix A.1.

2.4 Theoretical framework

According to Crivelli et al. (2016) two types of spillover effects regarding international corporate taxation can be distinguished: base spillovers and strategic rate spillovers. They define the base spillover as the impact that a country's tax policy has on other countries' tax bases. In other words, the base spillover is the impact that tax differences have on multinationals. Two main channels of the impact are allocation of real investment and/or profit shifting. Strategic spillover effects on the other hand are defined as tax competition: the impact that tax changes abroad have on another country's tax policy choices (Crivelli et al. 2016). To keep the focus of this paper on multinationals' profit shifting, I will only study the base spillover effects and the profit shifting channel more precisely in the next chapters.

Theoretical framework for tax base spillover effects as well as for tax competition is based largely on two complementary models. These two standard models are the Zodrow, Mieszkowski, and Wilson (ZMW) model as well as the Kanbur and Keen (KK) model (Keen and Konrad, 2013). The second channel of tax base spillover effects, shifting profits, can be studied by ZMW-model by extending the model to also profit shifting (Crivelli et al. 2016). I will introduce the ZMW-model as well as the profit shifting extensions to it in the following chapter. Afterwards, I will discuss the second workhorse model, KK-model, and how to interpret the results of this KK-model to profit shifting.

Where the ZMW-model is applied to n countries, KK-model assumes a case with only two countries. Keen and Konrad (2013) also point out an important difference between the ZMW- and KK-models. It should be noted that tax rates in the ZMW-model are interpreted as marginal effective rates, and in the KK-model the tax rates are interpreted as statutory rates. This implies that the ZMW-model tax rates capture the effect that investing a little more has on tax rates and tax base. The tax rates in profit shifting are instead thought to be corresponding to the statutory rates. The difference emerges from the fact that shifting investments has for example impacts on the depreciation allowances claimed, which profit shifting has no impacts on (Keen and Konrad, 2013).

2.4.1 The Zodrow, Mieskowski and Wilson (ZMW) model

The model by Zodrow and Mieskowski (1986) and Wilson (1986) provides a foundation for the literature of international tax competition. Keen and Konrad (2013) introduce the ZMW-model as a world of n countries. Each country i $(i = 1, \ldots, n)$ is characterized by a production function of $f_i(k_i)$, where k_i is the capital-labor ratio and f_i denotes the output per worker (Keen and Konrad, 2013). Additionally,

labor supply in country i is assumed to be its population share, h_i, of the global population. In other words, h_i describes the relative size of the country whilst world total population is normalized to unity (Crivelli et al., 2016).

Following the representation of the model by Keen and Konrad (2013) again, each country i then chooses a source-based unit-tax t_i[7]. Since the model assumes capital to be perfectly mobile across all jurisdictions, investors may invest in any country they wish. Therefore, in equilibrium all investors receive the same after-tax rate of return on capital, ρ, that is for all i:

$$f_i'(k_i) - t_i = \rho. \tag{1}$$

The ZMW-model also has a market clearing condition, since the aggregate world capital-labor ratio is fixed at a certain level $\bar{k}$. Following Crivelli et al. (2016), I denote the market clearing condition as:

$$\sum_{i=1}^{n} h_i k_i = \sum_{i=1}^{n} h_i \bar{k}_i = \bar{k}. \tag{2}$$

Keen and Konrad (2013) show that the equations 1 and 2 together determine the capital allocated to each country as well as the net rate of return of tax rates in all countries[8]. They also show that an increase in the tax rate of a country i reduces the amount of capital employed there and increases the amount of capital employed in other countries j. Capital will flow from country i to other countries j until country i's gross marginal product of capital has increased and the gross marginal products of other countries j have reduced to the same level and the arbitrage condition has been brought back to balance. Keen and Konrad (2013) show also that the welfare W_i of a typical citizen of country i can be denoted as:

$$W_i = f_i(k_i) - f_i'(k_i)\, k_i + \rho \bar{k_i} + G_i(t_i k_i), \tag{3}$$

where G_i is the per capita amount of publicly provided good, financed by the per capita tax revenue $t_i k_i$. Thus, the welfare of a citizen is the sum of its private consumption financed by $f_i(k_i) - f_i'(k_i)\, k_i + \rho \bar{k}_i$ and the provision of public goods $G_i(t_i k_i)$.

Keen and Konrad (2013) further show that each country maximizes their welfare according to equation 3 by choosing its tax rate t_i while taking other countries' tax rates as given. A country should also anticipate the impact of their tax rate

[7]Taxes levied on source-basis means that the unit tax is levied on each capital unit invested, generating a tax revenue of $t_i k_i$.

[8]See Keen and Konrad (2013).

on the allocation and net return to capital. This standard version of the ZMW-model presented by Keen and Konrad (2013) focuses on the impact that tax rates have on multinationals' decisions on how to allocate investments between different countries. To include also the other type of tax base spillovers, profit shifting, the model requires some extensions.

Crivelli et al. (2016) present this standard model with added possibilities for profit shifting. The extended model begins by examining a behavior of a multinational company. This multinational company has an affiliate in each country i and the revenue of the affiliate in country i is denoted by $f_i k_i$. The capital-labor ratio is denoted by k_i and the multinational has a total capital available of $\bar{k} = \sum_{j=1}^{n} h_j k_j$ that it can allocate across the n countries (Crivelli et al., 2016).

Crivelli et al. (2016) introduce the extension of profit shifting by enabling the multinational to shift its tax base, pretax profits, between affiliates operating in different countries. I denote shifting profits into country i from country j by $s_{ij} = -s_{ji}$. There are also costs related to profit shifting, like administrative and reputational costs. Following Crivelli et al. (2016), the cost is assumed to be independent of the location of real capital and the cost is denoted by a quadratic form of $\frac{1}{2}\Delta_{ij} s_{ij}^2$ with all $\Delta_{ij} \geq 0$.

As in the basic ZMW-model, each country i is assumed to levy a source-based tax at rate t_i. The total tax base of country i therefore consists of real capital located in the country, $h_i k_i$, and the base shifted into country i:

$$b_i = h_i k_i + \sum_{j=1}^{n} s_{ij}. \tag{4}$$

Following Crivelli et al. (2016), I denote the world interest rate as ρ, which is taken as given by the multinational. However, ρ can also be interpreted as the shadow value of the multinational's aggregate capital – as it was interpreted in the standard ZMW-model. To keep the model simple, costs of shifting tax base are assumed not to be tax-deductible. Thus, Crivelli et al. (2016) show that the multinational's after-tax profit is:

$$\Pi = \sum_{i=1}^{n} \left\{ h_i f_i\left(k_i\right) - \rho h_i k_i - t_i \left(h_i k_i + \sum_{j \neq i}^{n} s_{ij} \right) - \frac{1}{2} \sum_{j \neq i}^{n} \Delta_{ij} s_{ij}^2 \right\}. \tag{5}$$

From this multinational's profit equation (equation 5) can be seen that the multinational has two decisions to make: the allocation of real capital across countries (k_i) and profit shifting (s_{ij}) between countries. Maximizing the profits from the allocation of real capital is done by the multinational according to the equation 1, already

presented in the standard ZMW-model. Investors, in this case the multinational, will allocate its capital to equalize the after-tax return of its investments, that is its affiliates. If the after-tax return is not the same for all affiliates, the multinational could earn more by reallocating its capital (Crivelli et al., 2016). The tax rate effects discussed in the standard ZMW-model are applied to this investment decision of the multinational. In other words, if the tax rate increases in country i, the multinational will reduce the amount of capital allocated there and at the same time, the tax rate increase in country i will increase the multinational's capital investments in other countries j.

It should be noted that the magnitude of the tax effect itself is dependent on the countries size. Keen and Konrad (2013) show that:

$$\frac{\partial k_i}{\partial t_i} = -(1 - h_i) < 0 \tag{6}$$

$$\frac{\partial k_i}{\partial t_j} = h_j > 0. \tag{7}$$

These imply that a tax change in a country j increases real investment in country i the more the larger is the country j. Large economies in turn are not much affected by the low tax rates of small economies (Crivelli et al., 2016).

Returning to the second decision of multinationals, the decision of profit shifting, the size of countries do not affect the impacts that a country i's tax rate change may have. Crivelli et al. (2016) show that the first-order condition of the multinational's profit equation (equation 5) with respect to s_{ij} is:

$$\delta_{ij} s_{ij} \equiv (\Delta_{ij} + \Delta_{ji})\, s_{ij} = t_j - t_i \forall i, \forall j \neq i, \tag{8}$$

such that $t_j > t_i$. This implies that the multinational shifts profits form a high tax country j to a low tax country i, until the multinational reaches the point where the saved amount of tax on the marginal dollar is equal to the cost of profit shifting δ_{ij}. The cost of profit shifting is also assumed to be positive for all countries, so that $\delta_{ij} > 0$ for all i and j. Thus, the tax responsiveness of profit shifting can be given by:

$$\frac{\partial s_{ij}}{\partial t_j} = -\frac{\partial s_{ij}}{\partial t_i} = \frac{1}{\delta_{ij}} > 0. \tag{9}$$

Equation 9 shows that profit shifting from country i to country j is not dependent on the country's size: scale of profit shifting is only dependent on the cost of profit shifting between the countries, δ_{ij}. Being dependent only on the transaction

cost means that also large economies are affected by low tax rates offered in small economies (Crivelli et. al, 2016).

The effect on country i's tax base caused by these two effects (real investment and profit shifting) can be modelled. The effect that a small change $(dt_1, \ldots, dt_n)$ in all tax rates has on the country i's tax base can be denoted by $db_i = h_i dk_i + d\left(\sum s_{ij}\right)$ (Crivelli et al., 2016). Crivelli et. al (2016) also show that the change in tax base can be written in a per capita form:

$$\frac{db_i}{h_i} = \beta_i \left(dt_i - \sum_{j \neq i} \omega_{ij} dt_j \right), \tag{10}$$

where $\beta_i \equiv -\left\{(1 - h_i) + \sum_{j \neq i}^{n} \left(\frac{1}{h_i \delta_{ij}}\right)\right\} < 0$ and $\omega_{ij} \equiv \frac{h_j + \left(\frac{1}{h_i \delta_{ij}}\right)}{1 - h_i + \sum_{p \neq i} \left(\frac{1}{h_i \delta_{ij}}\right)}$.

Thus, Crivelli et al. (2016) argue that the impact of a tax rate change on country i's tax base is dependent entirely on how the tax change affects the difference between country i's own rate and the weighted average tax rate of all other countries. The term of weights ω_{ij} also captures the two channels, real investment and profit shifting, which base spillover effects of tax rates may operate. If the real investment channel is the only way of base spillovers, the weights transform to:

$$\omega_{ij} = \frac{h_j}{1 - h_i}. \tag{11}$$

This could happen for example when the transaction cost of profit shifting δ_{ij} becomes infinitely large. In this case, the impact of tax rate in country j on the tax base of country i depends only on the relative sizes of countries j and i (Crivelli et al., 2016).

Crivelli et al. (2016) also show that if the only channel of base effects is through profit shifting, the weights turn into:

$$\omega_{ij} = \frac{1/\delta_{ij}}{1/\sum_{p \neq i} \delta_{ip}} \tag{12}$$

In this situation, only the relative ease with which profits can be shifted in or out of the countries have an impact on the tax base of country i (Crivelli et al., 2016).

2.4.2 The Kanbur-Keen (KK) model

In addition to the ZMW-model, another workhorse model for international tax competition is the model introduced by Kanbur and Keen (1993). The KK-model was originally used to model commodity tax competition. Nevertheless, the model can

be reinterpreted and used to study profit shifting and I will introduce the model by following the presentation of Keen and Konrad (2013).

Following Keen and Konrad (2013), the framework of the KK-model is based on a case with two countries, $i = 1, 2$, that are each length of unity. The two countries also share a border between them. Each country i has a population h_i that is distributed uniformly, but the population sizes differ between the countries. Consumers buy only one unit of the good and they can purchase the good from either of the two countries. If the consumer buys the good from its home country, the consumer needs to pay the local tax, t_i. The consumer can also travel to the border and buy the good at a tax-inclusive price from a foreign country. In the latter case, the consumers pay a transport cost of δ and the tax of the foreign country, t_j (Keen and Konrad, 2013).

Additionally, Keen and Konrad (2013) assume that country 1 is a low-tax country, then $t_1 < t_2$. In this case, the consumers of country 1 will buy at home and consumers located in country 2 will buy abroad if and only if $t_1 + s\delta < t_2$. The tax in the low-tax country added with the transportation costs must be smaller than home country tax in order for the consumer to travel and purchase the good from abroad. By parameter s is I denote the distance which the consumer has from the border and the transportation costs intuitively are dependent from s. By solving for s, I show the proportion of country 2 consumers, s^*, that will shop abroad:

$$s^* \equiv \frac{t_2 - t_1}{\delta}. \tag{13}$$

Next, Keen and Konrad (2013) argue that tax revenues of the countries 1 (r_1) and 2 (r_2) are:

$$r_1 = t_1 \left(h_1 + h_2 \left(\tfrac{t_2 - t_1}{\delta} \right) \right); \quad r_2 = t_2 h_2 \left(1 - \left(\tfrac{t_2 - t_1}{\delta} \right) \right) . \tag{14}$$

Interpreting the above, we can see that the low-tax country 1 receives a revenue gain from the proportion s^* of the h_2 and high-tax country accordingly suffers a loss from the sales of the consumers shopping abroad, s^*. Both countries are assumed to maximize its tax revenues when the tax rate of the other country is taken as given. With $\eta = \frac{h_1}{h_2}$, Keen and Konrad (2013) show that the best responses for the tax rates are:

$$t_1 (t_2) = \tfrac{1}{2} (\delta\eta + t_2); \quad t_2 (t_1) = \tfrac{1}{2} (\delta + t_1) . \tag{15}$$

According to Keen and Konrad (2013) there is a discontinuity in the best response of the small country. If the larger country would set a low rate, the smaller country would need to set a very low rate in order to attract the consumers from the larger

country. This rate would need to be so low that it would not generate enough tax revenue from the foreign consumers to offset the lost tax revenue from the domestic consumers caused by the lower tax rate. However, there is a point where the tax rate of the larger country increases enough and undercutting the tax rate becomes an optimal strategy for the smaller country. In this point the discontinuity of the smaller countries best responses emerges (Keen and Konrad, 2013).

Kanbur and Keen (1993) show that despite the discontinuity, there exists a Nash equilibrium where the tax rates of the countries are:

$$t_1^N = \delta\left(\left(\tfrac{2}{3}\right)\eta + \tfrac{1}{3}\right); \quad t_2^N = \delta\left(\left(\tfrac{1}{3}\right)\eta + \tfrac{2}{3}\right) \ . \tag{16}$$

Keen and Konrad (2013) argue that from these Nash equilibrium tax rates (equation 16), can be captured the intuition why smaller countries set lower tax rates. Small countries have more to gain from lower tax rates as it attracts foreign consumers. This larger gain partly exists because the loss of tax revenue related with cutting the taxes is smaller since its own tax base is smaller (Keen and Konrad, 2013).

To use the KK-model for profit shifting interpretation, following again the presentation of Keen and Konrad (2013) a multinational Π_i with profits in two countries, $i = 1, 2$, is considered. The declared profit of the multinational in country i differs from the true profit by the amount of profit shifting the multinational executes. Since it is assumed that $t_1 < t_2$, the multinational has an incentive to shift its profits into country 1. Thus, the true profit is bigger in country 2 and smaller in country 1 than compared to the declared profits. By s is now denoted the fraction of true profit that the multinational shifts from country 2 to country 1.

Additionally, it should be again noted that profit shifting is not cost-less: costs may arise from some organizational costs, distortion of activities or simply from the risk of penalty. The cost of shifting profits is defined by Keen and Konrad (2013) as $\frac{1}{2}\delta s^2 \Pi_i$. Since the cost of profit shifting is assumed to be nondeductible, they show that the multinational's net profit, Π, is:

$$\Pi = \Pi_1 + \Pi_2 - t_1\left(\Pi_1 + s\Pi_2\right) - t_2\left(\Pi_2 - s\Pi_2\right) - \left(\frac{1}{2}\right)\delta s^2 \Pi_2. \tag{17}$$

The multinationals net profit Π consists from the true profits derived in each country deducted with the costs of shifting profits and the tax liabilities associated with each country.

The multinational wants to maximize its profit and therefore, the net profit equation of the multinational (equation 17) is maximized with respect to s, the proportion of profits shifted from country 2 to country 1. This leads to the exactly same s^* as with the equation 13 that derived the proportion of customers shopping abroad, showing now the optimal amount of profit shifting for the multinational

from country 2 to country 1. Also, tax revenues in this case are similar with the equation 14 except the true profit Π_i replaces the population size h_i. Thus, the conclusions drawn from the standard KK-model of commodity taxes can also be translated to conclusions of profit shifting (Keen and Konrad, 2013).We can also conclude from the model that when the cost of shifting profits (δ) increases, the optimal amount of profit shifting for the multinational (s^*) decreases.

This introduced theoretical framework explains why multinationals may find it optimal to shift their profits to low tax countries. Next, I will move on to discussing the previous empirical literature that has estimated the scale and channels of profit shifting behavior. I will review the basic estimation approach first and then, discuss the most relevant previous studies and their results on the field of profit shifting.

3 Literature review

I have divided this chapter into two parts in order to deliver the reader a comprehensive understanding of the empirical literature of profit shifting. Firstly, I review the very basic estimation approach used for estimating profit shifting behavior as many of the previous studies use some version of this model. Then, I introduce the most relevant studies and discuss the results they have derived.

3.1 Hines-Rice approach

According to the ZMW-model and KK-model, there clearly are incentives for multinationals to shift their profits. Next, we are interested in testing whether multinationals act according to these incentives, that is if they truly engage in profit shifting activities. Hines and Rice (1994) were early pioneers of the empirical estimation of multinationals' profit shifting. As Dharmapala (2014) noted, the "Hines-Rice" approach is based on the intuition that pretax income, π_i, of an affiliate i, is the sum of its "true" income (ρ_i) and "shifted" income (ψ_i). By true income Dharmapala (2014) refers to the income generated by the affiliate in country i using capital and labor inputs there. In addition to the true income, the affiliate's pretax income depends on the shifted income, ψ_i. The shifted income of affiliate in country i can either be negative or positive, depending on the incentives to move income in or out of the country. If the country has a lower tax rate compared to its the parent, the shifted income should be positive. On the other hand, country i with a high tax rate should have a negative shifted income. This division of multinationals profits to true and shifted parts was also seen in the KK-model introduced in the previous chapter.

Hines and Rice (1994) argue that the marginal cost of shifting profits is initially small but it increases in proportion to the ψ_i/ρ_i ratio. They also denote the factor of proportionality with a and thus, the total cost of shifting profits is $(a/2)\,(\psi_i^2/\rho_i)$. From this, Hines and Rice (1994) show that the pretax reported profit, π_i, of affiliate i, is:

$$\pi_i = \rho_i + \psi_i - \frac{a}{2}\frac{(\psi_i)^2}{\rho_i}. \tag{18}$$

For an affiliate i transferring profits out, $\psi_i < 0$ and for an affiliate receiving profits from the parents or other group affiliates, $\psi_i > 0$. However, the multinational's sum of ψ_i's is non-positive, since transferring profits should not in itself create any additional profits. Thus, Hines and Rice (1994) show that the firms have a constraint

regarding the shifted profits:

$$\sum_{i=1}^{n} \psi_i \leq 0. \tag{19}$$

Hines and Rice (1994) further argue that the multinational has incentives to choose its profit transfers (ψ_i) in a way that maximizes the multinational's after-tax profits. The multinational takes as fixed the profits earned by its factors, the true profits (ρ_i), thus:

$$\max_{\psi_i} \sum_{i=1}^{n} (1 - \tau_i) \pi_i = \sum_{i=1}^{n} (1 - \tau_i) \left[\rho_i + \psi_i - \frac{a}{2} \frac{(\psi_i)^2}{\rho_i} \right], \tag{20}$$

where τ_i is the tax rate of country i. Thus, the multinational's total profit is the sum of the after-tax profits, $(1 - \tau_i) \pi_i$, of its affiliates. The maximization with respect to the shifted profits, ψ_i, yields to the first-order condition of:

$$(1 - \tau_i) \left[1 - a \left(\frac{\psi_i}{\rho_i} \right) \right] = \lambda \tag{21}$$

where $i = 1, \ldots, n$ and λ is the Lagrange multiplier that corresponds to the constraint of equation 19. Solving for ψ_i, we get that

$$\psi_i = \rho_i \left[\frac{1 - \tau_i - \lambda}{a (1 - \tau_i)} \right]. \tag{22}$$

Substituting the above ψ_i in the affiliate i's pretax profitability function, equation 18, the affiliate's profit function receives the form of:

$$\pi_i = \rho_i \left[1 + \frac{1}{2a} - \frac{\lambda^2}{2a (1 - \tau_i)^2} \right]. \tag{23}$$

This equation indicates that the pretax reported profit (π_i) of affiliate i is a function of the true income (ρ_i) and the local tax rates. The value of true income (ρ_i) unfortunately cannot be directly observed. Hines and Rice (1994) argue that this pretax income can however be estimated based on the inputs of it, capital and labor input. In this case, the log transformation is useful as the relationship is nonlinear. Thus, taking logs of both sides of the equation, Hines and Rice (1994) show that this profit function yields to:

$$\log \pi_i = \log (\rho_i) + \log \left[1 + \frac{1}{2a} - \frac{\lambda^2}{2a (1 - \tau_i)^2} \right]. \tag{24}$$

Hines and Rice (1994) further note that to estimate the pretax profit, π_i, it is helpful to transform the last term of the equation into a linear function of tax rates.

They also note that if $\tau_i = (1 - \lambda)$, then the second term on the right hand side is zero, since $\log(1) = 0$. Linear function is formed by taking a first-order expansion of the equation 24 in τ_i, around the point where $\tau_i = (1 - \lambda)$, yielding to:

$$\log \pi_i \approx \log(\rho_i) + \frac{1 - \lambda}{a\lambda} - \frac{\tau_i}{a\lambda}. \tag{25}$$

To estimate the above, log of the true income ($\log(\rho_i)$), requires a specification of the production function. Hines and Rice (1994) suppose a Cobb-Douglas production function of $Q = cA^{\epsilon}L^{\alpha}K^{\phi}e^{u}$, where firms produce output Q measured in dollars. The constant term is referred with parameter c and A is the country's level of productivity which is measured by local per capita income. Labor input is denoted by L, capital input by K and u is a normally distributed stochastic term with a mean of zero. Thus, if the affiliates hire labor to maximize profits, Hines and Rice (1994) show that:

$$Q - wL = (1 - \alpha)\, cA^{\epsilon}L^{\alpha}K^{\phi}e^{u}, \tag{26}$$

where w is the cost of labor.

If the affiliate i is not financed by debt, then equation 26 represents the profit of the affiliate from its actual business, in other words, the true income of the affiliate, ρ_i. Hines and Rice (1994) show that by taking logarithms of both sides of the equation 26 and by inserting it to equation 25, the reported profit of affiliate i can be shown as:

$$\log \pi_i = \beta_0 + \beta_1 \tau_i + \beta_2 \log L_i + \beta_3 \log K_i + \beta_4 \log A_i + u_i, \tag{27}$$

where the constant is $\beta_0 = \log c + \log(1 - \alpha) + (1 - \lambda)/a\lambda$. The rest of the coefficients are $\beta_1 = -1/a\lambda$, $\beta_2 = \alpha$, $\beta_3 = \phi$ and $\beta_4 = \epsilon$. This equation 27 is the basic "Hines-Rice" approach used in many studies as the basis for estimating multinationals' profit shifting activities. The equation is a log-linear specification, meaning that the natural logarithm of the affiliate's pretax profit, π_i, is modeled as a linear function of the tax rate variable, τ_i. The coefficient, β_1, is therefore interpreted as percentage change in the affiliate's profit, π_i, when the tax rate, τ_i, changes by one unit (i.e. one percentage point). In other words, the coefficient of interest, β_1, represents the semi-elasticity of the pretax income with respect to τ_i (Hines and Rice, 1994).

Dharmapala (2014) notes that the tax variable (τ_i) is usually the tax rate differential between the parent and affiliate. The tax rate differential may also be calculated compared to the average of all the tax rates faced by the multinational. Heckemeyer and Overesch (2017) show that the incentive to exploit profit shifting

is equal to the tax rate differential:

$$semi - elasticity = \frac{\%\ change\ in\ reported\ profits}{change\ in\ the\ tax\ rate\ differential}. \tag{28}$$

3.2 Empirical literature

Now that I have reviewed the basic estimation approach introduced by Hines and Rice (1994), I will examine the previous studies and results on profit shifting. Devereux and Maffini (2007) categorize the previous empirical literature on the location of capital and investment into three different categories. The first category of studies contains those conducted with aggregate foreign direct investment (FDI) data. The second category is composed of studies using aggregate data on affiliates of multinationals. The most recent category, that is also the third category, consists of studies using individual company data. The second and third categories are also in the scope of profit shifting and therefore, I review only studies belonging to those categories.

The categorization introduced by Devereux and Maffini (2007) is nevertheless a good introduction to the subject and the evolution of the empirical literature related to the impacts that international taxation has on firms' locational choices. Firstly, I review studies conducted with aggregated affiliate data as those can be seen as the early pioneers of the empirical literature related to profit shifting. Then I will discuss the studies with individual company level data. Since the number of empirical literature in this field is enormous, I include only the most relevant studies in this review. Before moving on to studying Finnish multinationals, Chapter 3.2.3 shortly summarizes and discusses the previous studies.

3.2.1 Studies with aggregated country level data

One of the first studies examining the profit shifting behavior of multinationals was carried out by Grubert and Mutti (1991). They exploit the impacts that tax rates have on income shifting and trade of US multinationals. They use an aggregated country level data from the US multinational affiliates in 1982. The data is provided by Bureau of Economic Analysis (BEA) of the US Department of Commerce. Grubert and Mutti (1991) estimate the effect of tax rates on affiliate profitability by implementing several regressions. They proxy the profitability first by after-tax profit margin and then by after-tax rate of return on equity. They also use statutory and average effective tax rates in turn. For indicating the general profitability in country i, Grubert and Mutti (1991) use the growth rate of GDP. They find significant negative effects of tax rates on the affiliate profitability. The results by Grubert

and Mutti (1991) suggest for example that affiliates in a country with a 40% tax rate will report after-tax profit margins of 5.6% compared to affiliates in a country with 20% tax rate reporting after-tax profit margins of 12.6%. The after-tax profit margin, that is after-tax profit as a percentage of the net sales, is thus higher in countries with lower tax rates. They also find that multinationals' real investments and trade respond to tax rates, supporting the argument of multinationals acting according to tax rates.

Another early study of the profit shifting behavior of multinationals was conducted by Hines and Rice (1994), who also introduce the estimation approach discussed in Chapter 3.1. Hines and Rice (1994) use the same data as Grubert and Mutti (1991), which contains information on aggregate profit, capital and labor inputs of all US affiliates in a given country. Hines and Rice (1994) in a way extend the estimation approach introduced firstly by Grubert and Mutti (1991) even further by including proxies for the affiliate's true income, capital and labor input. They find semi-elasticity estimates between -2.25 to -12.99, suggesting that a percentage point increase in the tax rate is related to 2-13% decreased reported pretax profits. The estimated coefficient and its significance depend on the estimation method. Once Hines and Rice (1994) introduce population as an instrumental variable for controlling the endogeneity of local tax rates, the estimated coefficients as well as their standard errors grow. Also, they argue that the estimated results for the included quadratic tax term indicate that the tax affect is strongest at low tax rates and the marginal effect of taxes disappears completely once the tax rate of 43% is reached.

Using aggregate level data comes with restrictions to the interpretation of the results. As noted by Hines and Rice (1994), with aggregate country level data, the differences in productivity between firms as well as the possible differences between the shadow values of the income transfer constraints (λ's) cannot be considered. Thus, using aggregate country level data introduces measurement error. Other reasons why Hines and Rice (1994) propose careful interpretation of the estimated tax coefficients are that the tax rate is measured by an average annual rate for all affiliates in the country, some countries with only few US investments are excluded from the sample and the effect of non-tax attributes of tax havens, like bank secrecy laws, are not accounted for in the estimation in anyway. Additionally, we should interpret the results using population as an instrument for tax rate with the caveat in mind that the instrumental exogeneity condition may not be truly satisfied.

Clausing (2016) also exploits the data provided by BEA of the US multinational affiliates. Contrary to the studies by Grubert and Mutti (1991) and by Hines and Rice (1994), the study uses a panel data, i.e. the data contains observations from countries for time periods 1983-2012. This enables Clausing (2016) to control for

unobservable country-specific characteristics by including country fixed effects and this way supplements the previous studies. She runs regressions with and without the country fixed effects receiving 8 semi-elasticity estimates ranging between -1.85 and -4.61, with an average of -2.92. She provides estimates of the costs that profit shifting causes to economies and most importantly, finds that the revenue losses have increased recently. For example, the estimated annual tax revenue loss suffered by the US government is USD77-111 billion (Clausing, 2016).

3.2.2 Studies with individual company level data

As noted by Dharmapala (2014) the increased availability of affiliate level data sets enabled the movement to a micro-level analysis of the profit shifting behavior of individual multinationals. Dharmapala (2014) names the primary advantage of these individual company level data sets the ability to control for potential confounding factors. Huizinga and Laeven (2008) exploit a data set like this from year 1999, provided by Amadeus. Amadeus is a database maintained by Bureau van Dijk, which contains ownership and financial information on Europe-based firms. The estimation approach used by Huizinga and Laeven (2008) considers all tax rates faced by the multinational. In other words, the tax parameter τ represents thus the incentive to shift profits between the entire corporate group, not just from parent to affiliate but also from affiliate to another affiliate. They find an average semi-elasticity estimate of -1.31, which means that one percentage point increase in the tax rate differential is associated with a 1.31% decrease in the pretax income reported by affiliate i. Huizinga and Laeven (2008) also estimate semi-elasticities for each European country and find a semi-elasticity of -0.58 for Finland.

By using the affiliate level data, Huizinga and Laeven (2008) are able to control for unobserved country-specific and industry-specific factors, which may explain the substantially lower estimates compared to previous studies. They also introduce several robustness checks and estimate the regression with a similar instrumental variable of population as Hines and Rice (1994). Huizinga and Laeven (2008) find that their estimate of OLS regression might be biased downwards since by controlling for endogeneity of tax policy with the instrumental variable approach they receive an estimate of -1.77.

The use of individual company level data yields substantially smaller estimates compared to the aggregate country-level data estimates. With the affiliate level data, unobserved country-specific and industry-specific factors may be controlled. Even though this is a substantial improvement, the regressions may be made even more unbiased by using panel data which allows controlling for affiliate-specific character-

istics as well. The availability of panel data, that is data with several observations of the same affiliate in time, has increased substantially and many researchers have exploited them. The estimates in general are even smaller than those reported by Huizinga and Laeven (2008).

Saunders-Scott (2015) exploits the Orbis database provided by Bureau van Dijk to study if multinationals treat transfer pricing and debt-shifting as substitutes. The data sample used consists mainly of firms located in the European Union because the required financial information is missing from most of the firms located outside Europe. She obtains financial information for the sample firms for years 2003 to 2012. Saunders-Scott (2015) uses EBIT as the dependent variable and examines the changes in the reported EBIT caused by tightening thin-capitalization rules as well as earnings stripping rules. Each of these rules are targeted to limit the use of debt-shifting channel of profit shifting. The findings by Saunders-Scott (2015) suggest that multinationals treat transfer pricing and debt-shifting as substitutes. Introducing an earnings stripping rule is associated with a 3.8% decrease in reported EBIT. The regressions with all sample firms also include statutory corporate tax rate as a variable, resulting with tax semi-elasticity estimates of -0.66 and -1.08, with a mean semi-elasticity of -0.87 (Saunders-Scott, 2015).

Weichenrieder (2009) uses the Microdatabase Direct Investment (MiDi) -data provided by Deutche Bundesbank, which includes firm-level data on German-based multinational affiliates and German-owned multinational affiliates abroad. The panel of affiliates is over the period of 1996-2003. Weichenrieder (2009) studies the profit shifting in and out of Germany. First, he uses a fixed effects model with return on assets (ROA) as the dependent variable. He finds a tax coefficient of 0.049, implying that a foreign parent's home country tax rate increase of 10 percentage points is related to a half percentage point increase in German affiliates return on assets. Looking at the outward profit shifting from Germany, Weichenrieder (2009) tests whether the local tax rate of a foreign affiliate with an German parent has a stronger impact when the affiliate is entirely owned by the German parent and finds a semi-elasticity estimate of -0.4 for wholly owned affiliates.

Godar (2018) exploits the same firm level panel data as Weichenrieder (2009) to study profit shifting of those multinational affiliates that are based in Germany. The panel of affiliates in question is observed during the period of 1999-2015. Godar (2018) uses a Hines-Rice adjusted specification introduced by Weichenrieder (2009). As the dependent variable, the German affiliate's net-of-tax profit/loss is used. She also includes affiliate level controls, like turnover, liability ratio and ownership dummy (indirect/direct) and introduces time fixed effects as well as affiliate fixed effects. The estimated tax coefficient, which is the average tax in the home

countries of foreign investors, indicates that a foreign tax rate decline of 1 percentage point is associated with declining profits of the German-based affiliate by 3.6 percent. When replicating the estimations separately for those affiliates with tax haven investors and for those that do not have tax haven investors, the group of affiliates with tax haven investors results with an increased coefficient of 4.8 and the group with no tax haven investors does not show a significant semi-elasticity coefficient at all. This indicates a nonlinear relationship and confirms the view that profit shifting does not occur that strongly between high tax countries with only small differences in tax rates (Godar, 2018).

In addition to the Hines-Rice estimation approach, Godar (2018) introduces an alternative identification strategy which exploits the benefits provided by panel data. She includes a dummy variable that is equal to one when the investor's location is (or switches to) tax haven. This enables the identification of tax havens even if there were no tax rate changes. Godar (2018) finds that the appearance of a tax haven investor relates negatively on the German-based affiliate's reported profits. The estimated relation is a 36.5 percent decline in after-tax profits in Germany once tax haven investor or ultimate owner is reported (Godar, 2018).

Many of the studies exploiting firm-level data are restricted to European firms only because of the coverage of commercial databases, like the Amadeus database. Dowd et al. (2017) add to the empirical literature by studying the profit shifting of US multinationals. They use a panel data set of US tax returns from the years of 2002-2012 which is provided by the Statistics of Income Division (SOI) of the Internal Revenue Service. Dowd et al. (2017) argue that the main advantage of the data in use is that it has an extensive coverage of US multinational firms. They use net income (or loss) as the variable indicating for firm's profitability. Dowd et al. (2017) find a tax semi-elasticity of -1.4 with the linear specification. On the other hand, they find that with a quadratic specification, a decrease from 5% tax rate to a 4% tax rate relates to increased profits of 4.7% while a decrease from a 30% tax rate to a 29% tax rate only relates to increased reported profits of 0.7%. The findings suggest that log-linear specification may understate the elasticity of profits in low-tax countries and at the same time overstate it in high-tax countries (Dowd et al., 2017).

The approach used by Heckemeyer and Overesch (2017) differs from the already introduced studies that all use some version of the Hines-Rice approach. They in turn conduct a meta-analysis of the previous empirical studies in the field of profit shifting. In other words, they gather estimates received from previous studies and run meta-regressions. Heckemeyer and Overesch (2017) include 25 studies in the sample that provide in total 238 estimates. The sample is restricted to those that

have a measure of profit as the dependent variable. Heckemeyer and Overesch (2017) find a semi-elasticity of -0.8, i.e. as the tax differential increases by 1 percentage point it is related with reported profits decreasing 0.8%. This estimate can be seen as a consensus estimate based on previous studies and the estimate has been corrected for all misspecification biases (Heckemeyer and Overesch, 2017).

Beer et al. (2018) follow the approach introduced by Heckemeyer and Overesch (2017). They find that a 1 percentage point lower tax rate is associated with the reported profits increasing by 1%. Even though the approach was similar to Heckemeyer and Overesch (2017), the received estimate is somewhat larger. Beer et al. (2018) have a larger sample of empirical literature, 37 papers with 402 semi-elasticity estimates in total, which may explain partly why the estimate differs. In addition to the different sample size, they point out that different estimation strategies and inclusion of different control variables may cause the differences in the estimate compared to the one received by Heckemeyer and Overesch (2017).[9]

Dharmapala and Riedel (2013) also introduce a new estimation approach in order to estimate the scale of profit shifting by multinationals. They base the approach on the idea that once a multinational's parent experiences an exogenous earnings shock, it is expected to transfer a fraction of these earnings to the affiliates in low tax locations. The high tax country affiliates of the multinational are now working as a control group to include all other channels that parent's earnings may have on affiliates besides profit shifting, like technological spillover effects. Dharmapala and Riedel (2013) argue that this approach has two main advantages in comparison to the standard Hines-Rice type approach. The approach enables to control for unobserved country-year fixed effects and exploits a continuous variation in the parent's earnings. They exploit a panel data of European multinationals from 1995-2005 retrieved from the Amadeus database provided by Bureau van Dijk. Dharmapala and Riedel (2013) find that exogenous changes in parent's earnings relate significantly and positively to the low tax affiliate's profitability, relative to the high-tax affiliate's profitability. Their estimate suggests that about 2% of additional parent earnings are shifted to affiliates in low tax countries. By comparing the results derived with EBIT to those received with pretax profit, they find that the debt-shifting channel is the main channel of shifting since the results with EBIT are smaller. Dharmapala and Riedel (2013) also run a regression where the corporate tax rate is included and find a semi-elasticity of -1.13.

A similar panel data set of European multinational affiliates is also exploited by Dischinger and Riedel (2011). The data set is retrieved from the Amadeus database and also covers years 1995-2005. However, the research question addressed by

[9]For further details of the differences, see Beer et al. (2018).

Dischinger and Riedel (2011) differs from the studies introduced earlier. Dischinger and Riedel (2011) study whether multinationals relocate their intangible assets in response to differentials in statutory tax rates. The research question is aimed to assess the intellectual property channel of profit shifting. As discussed previously in Chapter 2.2, relocating intellectual property rights in low tax countries is one of the channels used by multinationals to shift their profits. Additionally, argued also by Dischinger and Riedel (2011), intangible assets provide multinationals increased opportunities for transfer mispricing. In order to test the relocation of intangible assets, intangible assets is used as the dependent variable and the affiliate's average statutory tax rate differential compared to other firms of the multinational is the independent variable of interest. Dischinger and Riedel (2011) find a semi-elasticity of around -1.1, indicating that once the tax rate differential increases by 10%, it is related to a 11% decrease in affiliate's intellectual assets. The study also controls for affiliate fixed effects, year effects, country-specific effects as well as affiliate size.

3.2.3 Summary of previous empirical literature

To conclude on the empirical literature, I discuss and compare the previous studies in this chapter. I also introduce some results on CIT revenues at the end of this chapter. Table 2 provides a summary of the dependent variable, data set and semi-elasticity estimates of the previous empirical literature. As noted by for example Dharmapala (2014), there has been a diminishing trend in the semi-elasticity estimates. Starting with the studies exploiting country level data, the estimates have more than halved in the recent studies excluding Godar (2018). Dharmapala (2014) argues that the use of panel data and fixed effects approaches account for a substantial part of the reduction in the estimates. However, the study by Godar (2018) shows a semi-elasticity of 3.6, and even 4.8 once allowing for non-linearity. These results are substantially higher than the previous estimates on individual affiliate level data.

It is important to distinguish the different channels of profit shifting and their relative scales in order to design effective preventive policies. Dharmapala (2014) points out that the previous empirical literature has highlighted transfer pricing and debt-shifting as the primary channels. One way to study the channels is to compare the semi-elasticities derived with different dependent variables. Table 2 concludes the different dependent variables used in the studies. Using earnings before interest and taxes (EBIT) as the profit variable excludes the debt-shifting channel of profit shifting. On the other hand, using pretax profits includes also the debt-shifting channel. Heckemeyer and Overesch (2017) find that the estimates are larger with pretax profits compared to EBIT and argue that transfer pricing

accounts for about two-thirds of the multinationals profit shifting activities. Beer et al. (2018) provide an estimate of the importance of the debt-shifting channel compared to other channels. They find that debt-shifting accounts for one-quarter of the total profit shifting.

Results from the meta-analyses by Beer et al. (2018) as well as by Heckemeyer and Overesch (2017) both suggest that the debt-shifting channel has a smaller role in profit shifting compared to the non-financial channels. However, Dharmapala and Riedel (2013) find indirect evidence that debt-shifting channel is the primary channel in use. They do highlight that this result may be due to the approach in use and additionally argue that transfer pricing is also an important channel but may not be the only one in use. Dharmapala (2014) also reminds that most studies try to provide an estimate of one of the channels rather than aiming to distinguish between the channels. This for one complicates the comparison of channels and therefore, conclusions may be hard to derive. Saunders-Scott (2015) yet studies the relationship between methods used to shift profits. She finds that multinationals think of transfer pricing and debt-shifting as substitutes, i.e. if the costs of one increases, the use of the other will then increase.

In addition to transfer pricing and debt-shifting, relocating intellectual property to low tax countries is a technique which multinationals may use to shift their profits. Dischinger and Riedel (2011) study whether the tax rates of affiliate's home country relate to the location of multinational intangible assets. They find that the lower the affiliate's tax rate is compared to other affiliates of the company group, the higher is the level of intangible assets of that affiliate. Results found by Dischinger and Riedel (2011) are statistically and economically significant, suggesting that relocating intellectual property is an important channel of profit shifting as well. Additionally, Beer et al. (2018) highlight that this Hines-Rice approach does not capture avoidance of PE status (as there are no profits reported in the country) and thus, the method neglects this channel of profit shifting outright.

Hines and Rice (1994) introduce the quadratic tax term to account for the non-linearity. Dowd et al. (2017) reintroduce the importance of including the quadratic and argue that ignoring it may underestimate the semi-elasticities in low tax countries and overstate them in high tax countries. Results from both of these studies suggest that there indeed is non-linearity. Also Godar (2018) finds that allowing for non-linearity by running regressions separately for those firms that have tax haven investors and those who do not have, increases the coefficient of tax semi-elasticity.

Another notable fact is that most studies concentrate on profit shifting between parent and affiliate. Multinationals often consist of more affiliates than just one and thus, interpreting results with studies concentrating on profit shifting done solely

between parent and affiliate may lead to incorrect analysis. Huizinga and Laeven (2008) provide a multi-country approach to estimate profit shifting and find evidence also of affiliate-to-affiliate profit shifting. They argue that studies focused on parent-to-affiliate profit shifting may thus miss a substantial part of profit shifting behavior.

Lastly, many studies provide estimates of corporate tax revenue losses. In order to get a view of the macroeconomic implications of profit shifting, these estimates are important. Beer et al. (2018) estimate that the revenue loss accumulates globally to USD49 billion in 2015 as where Clausing (2016) estimates the global loss to be much higher at USD279 billion in 2012. Clausing (2016) provides also an estimate for Finland of lost tax revenues in 2012 of USD1 billion which accounts for 18% of total corporate tax revenue in Finland according to her estimates. Tørsløv et al. (2018) exploit macroeconomic data of foreign affiliates and find that foreign firms are substantially more profitable than local firms in tax haven countries contrary to foreign firms being less profitable in non-haven countries. Tørsløv et al. (2018) also estimate that the lost CIT revenue is about 11% of total corporate tax revenue in Finland and globally about 10 %. These imply that profit shifting is a genuine concern also from the macroeconomic perspective, for Finland as well as for the global economy.

Table 2: Summary of previous studies

Study	**Application**	**Semi-elasticity**
Grubert & Mutti (1991)	• After-tax profit margin and after-tax rate of return on equity • Country-level data of US multinational affiliates 1982, n=29	-2.3
Hines & Rice (1994)	• Pretax non-financial income • Country-level data of US multinational affiliates 1982, n=73 • Population as an instrumental variable	-2.3
Clausing (2016)	• Gross profit • Country-level data of US multinational affiliates 1983-2012, n=1433	-2.9

Huizinga & Laeven (2008)	• Earnings before interest and taxes • Firm-level data of European multinational affiliates 1999, n=428 • Includes an estimate of affiliate-to-affiliate profit shifting	-1.3 (-0.58 for Finland)
Saunders-Scott (2015)	• Earnings before interest and taxes • Firm-level data of multinational affiliates 2003-2012, n=445712	-0.9
Weichenrieder (2009)	• Return on assets (ROA) • Firm-level data of German based affiliates 1996-2003, n=17671 • Tax rate increase in foreign country increases reported profits in Germany	-0.4
Godar (2018)	• Net-of-tax profit/loss • Firm-level data of German based affiliates 1999-2015, n=77365 • Tax rate increase in foreign country increases reported profits in Germany	-3.6
Dowd et al. (2017)	• Net income (or loss) • Firm-level data of US multinational firms 2002-2012, n=96959	-1.4
Heckemeyer & Overesch (2017)	• After-financing profit and EBIT • Meta-analysis of 25 empirical studies, n=238	-0.8
Beer et al. (2018)	• Reported semi-elasticity of pretax profits • Meta-analysis of 37 empirical studies, n=402	-1.0

Dharmapala & Riedel (2013)	• Pretax profit (and EBIT) • Firm-level data of European multinational affiliates 1995-2005, n=18408	-1.1
Dischinger & Riedel (2011)	• Intangible assets • Firm-level data of European multinational affiliates 1995-2005, n=37242	-1.1

4 Data and methods

4.1 Data

I use a firm level data retrieved from Orbis. Orbis is a commercial database provided by Bureau van Dijk (2019) that reports financial and ownership information for companies on a global sample. I restrict the sample to those foreign affiliates of ultimate owners based in Finland that have available accounts for years 2012 to 2017. The data in use is an unbalanced panel data since all firms do not have observations for each year and/or each variable.[10] Ultimate owner in this data set is defined as a company that has at least 50.01% of control of the affiliate. There are many key variables needed for the estimation that are identified from the Orbis data. For the dependent variable, affiliate's profit, there are many alternative variables that could be used. In this study, I use earnings before interest and taxes (EBIT) as well as profit (or loss) before taxation . As discussed earlier, using EBIT captures profit shifting done otherwise than with debt-shifting. Profit before taxation on the other hand captures profit shifting done through all channels, including also debt-shifting.

Proxying for the affiliate's capital input I exploit fixed, total and fixed tangible assets. As noted by Huizinga and Laeven (2008) fixed tangible assets are easier to value than intangible assets. To describe the affiliate's labor input in turn, Orbis provides two options: the number of employees or the costs of employees. Number of employees is more probably reported by affiliates but may not describe the labor input in an appropriate way. I introduce additional regressions using the alternative input proxies as robustness checks. Also, as control variables and additional descriptive variables, the database provides many alternatives from which I use operating revenue, debt ratio, NACE sectors and the name of the affiliate's auditor (if known). The debt ratio is derived by dividing the total debt of an affiliate with its total assets. I use the NACE sectors to limit the sample affiliates to only manufacturing firms and introduce the regressions using this restricted sample in Chapter 5.2. In addition, I generate industry dummies for additional cross-sectional regressions. This means that each industry will have its own dummy variable, and the dummy will receive 1 if affiliate i is in that industry, 0 otherwise.

I exploit the affiliate's auditor's name in turn to identify whether the affiliate is audited by a Big Four company. Idea is to test if there are any suggestions indicating that the clients of Big Four companies are more likely to engage in profit shifting activities. The term Big Four refers to the four largest accounting firms, which are KPMG, Ernst & Young (EY), Deloitte and PricewaterhouseCoopers (PwC),

[10] Chapter 5.2 provides regressions with a balanced version of the data set as a robustness check.

which together audit majority of companies, especially public companies. Big Four companies provide also other professional services for their clients, including taxation services and there has been some suggestions that Big Four clients may be more likely to shift their profits. Appendix A.2 includes a specification of the variables used in the estimation and the respective data sources.

In addition to the data of affiliate's financials and ultimate owners, data on corporate income tax (CIT) rates, GDP per capita and country populations are needed for the study. Statutory CIT rates are from the Corporate tax rates table provided by KPMG (n.d.). The tax rates used in this study, i.e. the tax rates of 2012-2017 of those countries included in the sample, are listed in Appendix A.3. I use GDP per capita to proxy for factor A of the production function, that is local productivity. I retrieve the yearly GDP per capita levels for the sample countries from the GDP per capita database provided by the World Bank (n.d.). The same database also provides information of total population for each country. I use the population variable as an instrument to control for the possible endogeneity of country's tax policy choices. The next chapter discusses further the methods in use.

For robustness checks, I run regressions with average effective rate (AETR) as proxying for the tax incentive of profit shifting. AETRs are provided by OECD (2018), but are unfortunately only available for the year 2017.[11] The AETR of a country is constructed in this database by taking a weighted average across finance- and asset-specific average effective tax rates. This on the other hand means, that the AETRs provided by this database are forward-looking instead of backward-looking as they would be if the rates would be calculated from firms' actual tax payments. Previous studies have used these backward-looking rates and thus, using the rates provided by OECD (2018) differ somewhat from the rates used in previous studies. I discuss the difference between using CIT rate and AETR in Chapter 4.3.

I restrict the basic sample of the study to those Finnish multinational affiliates that are located abroad and have available accounts for years 2012 to 2017. These restrictions cut off affiliates based in countries with limited public financial information.[12]Also, Orbis provides very limited information on tax haven based affiliates as well as those affiliates that are based in developed countries. Appendix A.4 presents the country distribution of the affiliates within sample. I discuss the possible consequences of the data restrictions in detail in Chapter 4.3. To be able to run a log-linear regression, negative and zero observations need to be excluded from the sample. Additionally, I am only interested in profitable firms as shifting profits re-

[11]Appendix A.3 includes the AETRs for 2017.

[12]For example in the US only public companies need to publish financial statements. Thus, the financial information available on US affiliates is very limited and they lie mainly out of the sample.

quires positive profits. After this exclusion, final sample consists of 1,951 individual affiliates with each affiliate observed for 4.9 years on average.

In this study, I use the main sample in three different ways which I will name as Panel A, B and C. Firstly, I use the sample at the individual affiliate level named as Panel A. Next, I group the affiliates so that the affiliates based in the same country and that are also affiliates of the same ultimate owner are aggregated. I then treat the aggregated affiliate is as one affiliate and I will refer to this data set as aggregated affiliates from now on. This data set, Panel B, consists of 1,445 affiliates which include observations of each aggregated affiliate for 4.9 years on average. Huizinga and Laeven (2008) implement a similar country level aggregation in their study. They argue that multinational's profit shifting depends on true profits at country level and therefore, considering affiliates of same multinational in the same country as individual affiliates may not show true profit shifting patterns.

Finally, I aggregate affiliates at a country level to replicate the Hines and Rice (1994) estimations. This aggregation also enables me to compare how the results change once aggregate country level data is used. Country level data set, Panel C, consists of observations from 43 countries with each country observed on average for 5.4 years. I do both of these aggregations before excluding zero and negative observations on the individual level.[13] After the aggregations, I also exclude zero and negative observations from Panels B and C.

Table 3 provides summary statistics of main variables used in this study. The table provides the three different panels and statistics of the financial variables of them separately. I also introduce the descriptive statistics of corporate income tax (CIT) rate, GDP per capita and average effective tax rate (AETR) variables at the bottom part of Table 3. I only present the descriptive statistics of these macro-level variables with Panel A.

According to the means reported in Table 3, on average, a foreign affiliate reports profit before taxation of 5.2 million euros, or accordingly EBIT of 3.3 million euros. As for labor inputs, on average an affiliate employs 127 workers and reports yearly costs of employees around 6.5 million euros. The capital input variables receive means of 9.5 (fixed tangible assets), 30.9 (fixed assets) and 102.2 (total assets) million of euros. Since fixed tangible assets is part of fixed assets and fixed assets is a part of total assets, the order of their sizes is rational. One noticeable fact is that a major part of fixed assets seems to be accounted by intangible assets as fixed tangible assets seems to only account for about one third of fixed assets. On average, the debt ratio of an affiliate is 14%.

[13]Chapter 5.2 provides additional regressions with a modified Panel C that is constructed after dropping individual negative and zero.

Table 3: Descriptive statistics of main variables

	Mean	St. dev.	Min	Max	Number
Panel A: all foreign affiliates as individual (1,951 individual affiliates)					
Profit before taxation[1]	5,221	54,573	1	3,365,940	8,189
EBIT[1]	3,255	19,522	1	527,131	8,152
Number of employees	127	309	1	4,718	6,372
Costs of employees[1]	6,474	20,063	1	338,553	4,994
Fixed tangible assets[1]	9,546	73,967	1	3,310,561	6,811
Fixed assets[1]	30,944	388,506	1	14,600,000	7,383
Total assets[1]	102,220	1,579,960	1	57,300,000	8,200
Operating revenue[1]	40,732	180,809	1	4,765,186	8,091
Debt ratio	0.14	0.41	0	14.31	5,316
Panel B: foreign affiliates aggregated by ultimate owner at country level (1,445 aggregated affiliates)					
Profit before taxation[1]	8,521	176,122	1	13,200,000	6,031
EBIT[1]	4,132	25,929	1	631,900	6,008
Number of employees	169	415	1	5,010	4,808
Costs of employees[1]	8,276	26,912	1	389,487	3,845
Fixed tangible assets[1]	13,100	103,575	1	3,435,661	5,025
Fixed assets[1]	56,288	653,388	1	31,400,000	5,409
Total assets[1]	153,183	1,917,005	1	57,300,000	6,037
Operating revenue[1]	54,709	237,376	1	4,765,186	5,954
Debt ratio	0.15	0.45	0	14.31	3,655
Panel C: foreign affiliates aggregated at country level (43 countries)					
Profit before taxation[1]	254,813	1,085,077	5	13,300,000	220
EBIT[1]	100,112	208,761	5	1,146,087	215
Number of employees	5,381	9,170	1	41,151	183
Costs of employees[1]	221,529	415,112	48	2,301,540	175
Fixed tangible assets[1]	364,592	848,567	2	6,151,050	212
Fixed assets[1]	1,936,471	5,349,884	2	34,500,000	220
Total assets[1]	4,656,134	15,400,000	31	103,000,000	220
Macro-level variables (with Panel A)					
CIT rate	0.22	0.05	0.09	0.4	8,200
GDP per capita[2]	29,127	20,839	1,290	105,943	8,200
AETR[3]	0.2	0.04	0.09	0.44	1,343

Notes: [1] in thousands of EUR. [2] in EUR, at current prices. [3] available only for the cross-section of year 2017.

Table 3 introduces the descriptive statistics of Panel B as well. As expected, all variables receive higher means compared to the means of Panel A. Especially the difference between the two profit measures stands out: the mean of profit before taxation increases from about 5.2 million euros in Panel A to 8.5 million euros in Panel B. This increase is relatively larger compared to the increase of the mean of earnings before interest and taxes which increase only to 4.1 million euros from 3.3 million euros. The debt ratio on the other hand stays almost equal, with an average of 15% within Panel B.

Table 3 provides also the descriptive statistics for Panel C. For example, Finnish multinational subsidiaries on average report profit before taxation of around 255 million euros and employ 5,381 workers in a foreign country. The control variables, operating revenue and debt ratio, are not that rational at the country level and thus, are neither included in the descriptive statistics nor in the Panel C regressions in Chapter 5.1. The CIT rate is on average 22%, ranging between 9% and 40%. AETR of 2017 on the other hand is on average 20%, that is slightly lower than the average CIT rate. Appendix A.3 lists the country- and year-specific tax rates. GDP per capita varies from 1,290 euros to roughly 106,000 euros with a mean value of about 29,000 euros.

To evaluate the representativeness of the sample affiliates to true foreign affiliates of Finnish multinationals, I use data on Finnish foreign affiliates by country groups provided by Statistics Finland (2019). The database provides yearly information by country groups on the business activities of Finnish foreign affiliates.[14] By comparing the values of variables, we can make some implications of how large share of all foreign affiliates is included in the sample. Comparing the totals of variables in the sample to those provided by Statistics Finland is done for every year within the time period. The yearly total of sample affiliate operating revenue is on average 37% of total operating revenue (noted as turnover by Statistics Finland) declared by Statistics Finland. Number of affiliates included in the sample in turn is on average about 28% compared to the number of affiliates provided by Statistics Finland. Similarly, number (costs) of employees in total of the sample affiliates is about 26% (23%) of the corresponding totals of Statistics Finland. Unfortunately, no profit measures are provided by Statistics Finland and therefore, I cannot do the comparison with the profit variable.

Table 4 provides a correlation matrix for the main variables of the study. I include both company profits variables, that is earnings before interest and taxes (EBIT) as well as profit before taxation (PBT), GDP per capita and CIT rates in

[14]The country group of Africa is left outside the calculation of totals in Statistics Finland data as the sample here does not include any countries based in Africa.

Table 4: Correlation matrix of main variables with Panel A

	EBIT	**PBT**	**GDP per capita**	**CIT rate**
Profit before taxation	0.4477*	1		
GDP per capita	0.0229*	0.0348*	1	
CIT rate	0.0530*	0.0476*	0.5060*	1
Costs of employees	0.4230*	0.3484*	0.1039*	0.1416*
Number of employees	0.2416*	0.1706*	0.0206	0.1075*
Fixed tangible assets	0.4883*	0.1995*	0.0231*	0.0067
Fixed assets	0.2586*	0.6241*	0.0374*	0.0129
Total assets	0.4069*	0.5206*	0.0435*	0.0125
Operating revenue	0.7822*	0.5591*	0.0769*	0.0744*
Debt ratio	-0.0115	-0.0135	-0.1316*	-0.1049*
AETR[1]	0.0716*	0.0897*	0.3919*	0.9215*

Notes: * denotes significance at the 5% level. [1] Available only for the cross-section of year 2017.

the upper part of the table. These correlations are for all sample affiliates, i.e. I estimate the correlations with Panel A. The estimated correlations are as hoped since they suggest that the capital as well as labor variables are positively related to both profit variables and with GDP per capita. Especially the correlations between profit before taxation and fixed as well as total assets suggest a strong correlation.

The positive and quite strong correlation of GDP per capita and costs of employees may suggest that high productivity countries have more expensive labor force, as would be expected. Additionally, the CIT rate is positively correlated with GDP per capita indicating that rich countries are likely to have higher corporate income tax rates. CIT rate is also positively correlated with both labor proxies. Debt ratio in turn does not show significant correlation with profit variables, which is unexpected. Average effective tax rate (AETR) is positively correlated with both profit measures, GDP per capita and CIT rates. The correlation between CIT rates and AETR is unsurprisingly, very strong. Also compared to CIT rates, AETR is slightly more correlated with the profit measures.

4.2 Estimation methods

Since I use a panel data set, the basic estimation approach introduced by Hines and Rice (1994) reviewed in Chapter 3.1 needs to be extended to apply for a panel data.

At the time, when Hines and Rice presented the model, only aggregated country level data was available. Dharmapala (2014) argues that the increased availability of affiliate level data sets has allowed the researchers to shift from the aggregate country level analysis to a micro-level analysis of individual multinationals. These affiliate level data sets are also usually in the form of panel data which means that the data sets have information on the same affiliates and multinationals for several years. By using these panel data sets and techniques for it, Dharmapala (2014) argues that researches may provide more credible estimations of the profit shifting behavior of multinationals. Dharmapala (2014) shows that with a panel data, the modified Hines-Rice approach is:

$$\log \pi_{it} = \beta_1 \tau_{it} + \beta_2 \log L_{it} + \beta_3 \log K_{it} + \beta_4 \log A_{it} + \mathbf{X}_{it}\gamma + \mu_i + \delta_t + u_{it}. \quad (29)$$

Thus, Dharmapala (2014) argues π_{it} represents now the reported profit of the multinational's affiliate i in year t. The affiliate fixed effects are described with the new term μ_i, which controls for the affiliate i's unobserved characteristics that do not change over time. The time fixed effects in turn are described with δ_t, which control for unobserved factors affecting profits of all affiliates in year t. Term $\mathbf{X}_{it}$ in turn is a vector of additional affiliate controls, for example industry controls (Dharmapala, 2014).

In the panel data estimation, we should notice that the tax rate variable τ_{it} now represents the incentives to shift profits into or out of affiliate i in year t. Dharmapala (2014) argues that this incentive is measured usually by the tax rate difference between the parent and the affiliate i. Thus, if the affiliate i is in a low tax country, the parameter will be positive (profits are shifted into the affiliate) and if the affiliate i is in a high tax country, the parameter will then be negative (since profits are shifted out of this affiliate). As noted by Dharmapala (2014), changes in the tax differential between affiliate i and its parent (or another affiliate of the group) emerges often from tax reforms in either the country of the affiliate or in the country of the parent and therefore, is unlikely to be a direct consequence of the affiliate's own choice. In this study, using the affiliate's home country tax rate makes more sense than using the tax differential between affiliate and parent as the proxy for tax incentives of profit shifting. This arises from the sample in use: in contrary to the studies using mostly international data samples, only affiliates of Finnish multinationals are included in this study. This way, all parents of the sample affiliates have the same tax rate (i.e. tax rate of Finland) and I can use the affiliate's home country tax rate solely.

For this study, I have two different modified approaches. The first one is applied to data sets of Panel A and Panel B. The approach is similar to the one presented by Dharmapala (2014), that is equation 29, where the affiliates profit (π_{it}) at time t is regressed with the affiliate's home country tax rate (τ_{it}), log of labor input (L_{it}), log of capital input (K_{it}), log of productivity (A_{it}), a vector of control variables ($\mathbf{X}_{it}$), affiliate fixed effects (μ_i), time fixed affects (δ_t) and the error term (u_{it}). I run the regressions with several variations by changing control variables as well as the proxies for profit and inputs.

With Panel C, the aggregated country level, I can use a similar approach as suggested by Hines and Rice (1994) by extending the approach to a panel data. The estimation approach used for Panel C is:

$$\log \pi_{it} = \beta_0 + \beta_1 \tau_{it} + \beta_2 \log L_{it} + \beta_3 \log K_{it} + \beta_4 \log A_{it} + u_{it}, \tag{30}$$

where the aggregated profits of country i's affiliates (π_{it}) at time t is regressed with the country's tax rate (τ_{it}), log of labor input (L_{it}), log of capital input (K_{it}), log of productivity (A_{it}), and the error term (u_{it}). Term β_0 is the constant term and consistently, the vector of affiliate level vectors is missing since the affiliate specific controls are not rational at the country level setting. Chapter 5.1 introduces results for all panels.

The assumptions of the model are important as they affect the interpretation of the results. An important assumption regarding the Hines-Rice approach is that the Cobb-Douglas production function and the chosen labor, capital and productivity proxies predict the true income of an affiliate in a meaningful way. Then, the additional income reported by the affiliate that cannot be accounted for affiliate's true income from real activity is seen as the shifted income part of profits (Dharmapala, 2014). The shifted income is determined by the tax incentive, which for I use tax rate as a proxy. Following Hines and Rice (1994), I assume GDP per capita to be exogenous. In Chapter 5.2, I provide additional regressions using alternative pretax profit and input proxies as well as an alternative tax measure. I do these robustness checks in order to test that the chosen measures do not affect the results in a substantial or a systematic way. Additionally, I provide additional regressions with different sample restrictions in order to test the credibility of my main sample.

4.3 Potential problems with the estimation and data

Assuming that tax policy is exogenous to the reported pretax profits may be misleading. As noted by Hines and Rice (1994), if countries set tax rates in response to some unobservable factors captured in the residual u, the tax policy is no longer

exogenous to the reported pretax profits and therefore may lead to biased OLS coefficients and the estimated tax effect may be understated compared to the true tax effect. Huizinga and Laeven (2008) suggest that to implement counter-cyclical tax policy, countries can increase their tax rates in response to higher profitability at the oak of business cycles. Thus, the exogeneity assumption is not valid in this case.

Additionally, Huizinga and Laeven (2008) argue that reported pretax profits can be higher in high tax countries since these countries provide substantial public inputs like high-quality infrastructure, which on the other hand can contribute to higher reported profits. Devereux and Maffini (2007) also note that if a large number of firms locate close to each other, they are likely to have political influence and thus, have an impact on low tax rates. Same industry firms are likely to locate near to each other because of the agglomeration benefits. Devereux and Maffini (2007) argue that ignoring these agglomeration benefits and assuming that the low tax rates is the feature attracting the new firms may lead to incorrect conclusions. Hines and Rice (1994) argue that the estimated tax coefficients may also overstate the true tax effect. This problem may arise if the tax rates are endogenous to the firms' commitments of legal and accounting resources. In that case, the tax rates are likely to be lower in profitable locations, which on the other hand leads to estimated tax coefficients overstating the true tax effect.

Hines and Rice (1994) aim to reduce this possible endogeneity bias by introducing population as an instrumental variable. The idea behind the instrumental variable regression is that the introduced instrument controls the unobserved correlation between the explanatory variable, log of tax rate, and the dependent variable, pretax profits. By including an instrumental variable, the consistent estimation of the regression is permitted. Hines and Rice (1994) argue that population can be used as an instrument for the tax rate since small countries tend to have lower tax rates and thus population is positively related the population size. On the other hand, for the instrument to be reliable, it should be exogenous, i.e. not correlated with the dependent variable. Hines and Rice (1994) argue that population size of a country should not affect the profit and therefore, population can be used as an instrument for the tax rate. This assumption that population affects pretax profits only through profits is called the instrumental exogeneity restriction. There are some worries whether this condition can really be satisfied as we could argue that population could affect profits also through other channels. For example a country with larger population has more customers available and thus, may enable firms to yield higher profits. As suggested by Klassen and Laplante (2012), another possibility is to instrument tax rate by its lagged levels. They argue that lagged values can be used as instruments because the tax incentives to shift profits is quite persistent, i.e.

stable across time. This way they can control for the portion of the tax rate that is related to the incentives to shift profits. Again, the instrument exogeneity condition can be questioned: whether there is any other way through which previous tax rates affect current pretax profits in addition to the current tax rate.

I assume all the variables of true income, capital and labor input as well as productivity, to be exogenous. Clausing (2016) highlights the possibility of profit shifting activities being related to the employment, capital investments and even GDP per capita. She argues that especially the GDP measures of tax haven countries are likely to be affected by profit shifting as profit shifting may distort the GDP measures. Therefore, including controls like GDP per capita may actually underestimate the tax incentives of profit shifting (Clausing, 2016). The same applies for the other controls: if they are not exogenous of profit shifting, including them may bias the tax coefficient toward zero. This possible limitation should be taken into consideration once interpreting the results with controls included in the specification.

Regarding the tax rate variable, Godar (2018) introduces reasons for why the often used statutory tax rate may not tell the whole story of profit shifting. First of all, statutory tax rates are not the only way countries may lure multinationals. She points out that many countries, for example Luxembourg, attracts profits with favorable rules regarding tax base definitions as well as other tax schemes like patent boxes. Statutory tax rates do not capture these effects. Thus, the use of average effective tax rate may reflect the tax burden in a more accurate way. Godar (2018) argues though that using the average effective tax rate is not that straightforward: average effective tax rate is also related to economic cycles in addition to tax laws. Another problem is that profits are used in the calculation of the average effective tax rate which in turn introduces endogeneity. This is an actual problem once using the affiliate level data in the calculation process. On the other hand, the average effective tax rates (AETR) provided by OECD (2018) are constructed by taking an average of asset- and finance-specific AETRs at the country level and thus, should not introduce endogeneity in a similar way. However, these AETRs may not proxy the tax incentive as accurately as the AETRs calculated from affiliate level data do.

Another restriction of using tax rates as the explanatory variable is the fact that with fixed effects panel regression, tax rate variable will only capture effects of changes in the tax rates. In other words, if there are no changes in tax rates the regression will not capture any profit shifting in those countries. Godar (2018) points out that tax haven countries rarely change their tax rates and thus may not be captured in the regression. Within the time frame of this study, the corporate income tax rate of Finland changes (from 24.5 % to 20 % in 2014) causing variation

in the tax incentive variable in all regressions. Thus, this restrictionas should not be a problem in this study.

The data in place may also cause some limitations to the study. As discussed previously, the early studies using aggregate data suffered from not having the opportunity to control for confounding factors on the affiliate level, like productivity differences across firms. Hines and Rice (1994) note that the use of aggregate data like this may lead to measurement error and cause the insignificance of tax parameters. On the other hand, using affiliate level data may not be a clear solution. As noted by Tørsløv et al. (2018), multinationals are not required to publish financial information on affiliate level and since Orbis relies on public registries, the information on affiliates based in many countries are missing or incomplete. Clausing (2016) points out that Orbis provides only limited financial information on companies located in tax haven countries. This limitation in turn implies that studies exploiting Orbis data exclude tax haven affiliates almost inevitably out of sample: meaning that the observations driving most of the profit shifting behavior are not included in the analysis. As discussed in Chapter 2.3, tax havens are an important destination of profit shifting activities. Therefore, the results received with Orbis data may severely understate the true scale of profit shifting because they restrict inevitably tax havens out of the sample. Still as argued by Clausing (2016), many studies find substantial estimates of profit shifting using data sets like Orbis. So even without observations from tax haven affiliates, receiving significant estimates implies that profit shifting is a true phenomenon. Additionally, the database provides ownership information only from the last reported date (which is from year 2018 in most cases). Thus, there can be some miss-classification in the parent-affiliate relationships if the ownership structure has changed during the sample period. However, as the sample period is quite small (i.e. not that many years for acquisitions), this should not be an outstanding concern of the study.

Another restriction of the data is that it only measures the reported operations of the Finnish multinational affiliates. As noted by Hines and Rice (1994) the real prices of labor and capital inputs across countries probably differ from each other in ways that cannot be measured. Since the data can only provide the reported operations exchanged to euros, the real prices of the inputs can not be measured and therefore the reported prices must be used. Hines and Rice (1994) argue that this should reduce the estimates and so understate the effects that taxes have on profits. Therefore, estimates of profit shifting derived with this data are likely to be lower compared to the true scale of profit shifting activities.

Dharmapala and Riedel (2013) point out the complexity in interpreting results received with studies relying on the corporate tax rate changes. An increase in a

country's tax rate may affect the multinationals other choices, like lower incentives for effort, in addition to incentives to shift profits. This on the other hand also lowers reported profits. Dharmapala and Riedel (2013) argue that by using the tax rate differential between parent's home country and affiliate's location country, the unobserved country-year effects have been controlled. Country-year effects are for example all Sweden based multinational affiliates in 2014. On the other hand, the country-pair-year effects cannot be controlled with this approach. These are unobserved effects for example for all Sweden based multinational affiliates with a Finnish parent in 2014.

The methods used in this study may not necessarily account for profit shifting of the entire corporate group. Huizinga and Laeven (2008) find evidence of profit shifting between affiliates in addition to evidence of the more studied profit shifting between parent and affiliates. They include the entire corporate group to the study by using a tax rate variable that is defined as the tax differential between the affiliate's home country tax rate and the average tax rate of the corporate group. The results by Huizinga and Laven (2008) may imply that ignoring the affiliate-to-affiliate profit shifting, the results may miss a big share of the true profit shifting activities done by multinationals. Therefore, we should notice once interpreting the results that the used approach may not consider affiliate-to-affiliate profit shifting activities in an adequate way. Thus, these results may understate the true scale of profit shifting.

5 Results

5.1 Main results

Aim of my study is to replicate previously introduced models of literature with Finnish multinational data and see whether the results provide similar implications of profit shifting. Since the main goal of this study is to examine if Finnish multinationals engage in profit shifting activities, I exploit profit before taxation as the main dependent variable.[15] To draw some implications of the channels of profit shifting in use, Chapter 5.2 presents regressions with the alternative dependent variable. I start by reviewing the results with the data set of the individual affiliates, Panel A, with the regression form of equation 29 for the period of 2012-2017. To proxy for the labor input and capital input, I use costs of employees and fixed tangible assets. Choosing these proxies reduces the amount of observations since information on these variables were not available for all sample companies. On the other hand, costs of employees may be a more appropriate proxy for labor input compared to the number of employees. The number of employees itself may not reveal much information for example on the effectiveness of the company's labor. Similarly, I assume fixed tangible assets to be more easily valued compared to intangible assets. However, Chapter 5.2 provides regression results produced with alternative proxies as robustness checks.

Table 5 introduces results with profit before taxation as dependent variable with 5 different regression specifications and heteroskedasticity robust standard errors adjusted for affiliate clusters in parentheses. I use fixed effects model since the performed Hausman test suggests fixed effects model to be preferred to a random effects model.[16] Thus, all regressions control for affiliate fixed effects. I do not include year dummies in any of the regressions since all the performed F-tests for all regression specifications suggest that time fixed effects are not needed in any specification form (i.e. the null hypothesis that the coefficients for all year dummies are jointly zero cannot be rejected in any regression). Regressions 1 and 2 are based on the standard Hines-Rice approach and regressions 3 to 5 add additional control variables. I will refer to the regressions with the respective number of its column.

In the first column of Table 5, the tax rate coefficient results at an estimate of roughly -2.8 that is statistically significant at the 1%-level. Negative sign of the tax variable is what would be expected according to the theory of profit shifting,

[15] Profit before taxation captures profit shifting done through all channels, whereas using EBIT excludes the financial channels of profit shifting.

[16] I use Hausman test to decide between fixed and random effects models by testing the efficiency of the models. The null hypothesis of the test is that the random effects model is preferred whereas the alternative hypothesis suggests that fixed effects model is preferred.

Table 5: Regression outputs with Panel A and profit before taxation

Dependent Variable: Log Profit before taxation					
	(1)	(2)	(3)	(4)	(5)
Tax rate	-2.793***	-2.89***	-2.153**	-2.74**	-2.129**
	(0.969)	(1.071)	(0.88)	(1.117)	(1.164)
Log labor	0.592***	0.591***	-0.189*	0.608***	-0.237
(costs of employees)	(0.079)	(0.079)	(0.109)	(0.103)	(0.154)
Log capital	0.043*	0.043*	-0.023	0.037	-0.018
(fixed tangible assets)	(0.025)	(0.025)	(0.022)	(0.029)	(0.027)
Log productivity		0.078	0.064	0.443*	0.392*
(GDP per capita)		(0.197)	(0.182)	(0.228)	(0.215)
Log operating revenue			1.252***		1.302***
			(0.1)		(0.134)
Debt ratio				-1.065***	-1.06***
				(0.268)	(0.245)
Fixed effects	Firm	Firm	Firm	Firm	Firm
Observations	4,371	4,371	4,343	2,927	2,910
Number of affiliates	1,078	1,078	1,073	774	771
R-squared	0.586	0.585	0.691	0.559	0.68

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

since an increase in tax rate should relate to reported profits decreasing. Labor and capital input estimates on the other hand show positive signs. The estimated labor coefficient of 0.6 is statistically significant at the 1%-level whereas the capital coefficient estimate 0.04 is statistically significant only at the 10%-level. The estimates indicate that labor contributes relatively more to profit before taxation compared to the contribution of capital. Using the fixed effects may have an impact on the capital coefficient estimate as fixed tangible assets mostly remain equal from year-to-year meaning that this is partly captured by the affiliate fixed effects.

Next specifications include also the productivity variable, GDP per capita. In column 2 of Table 5 capital and labor inputs are not that affected by including GDP per capita as the coefficient estimates and their standard errors remain nearly unaffected. The main variable of interest, tax rate, on the other hand shows an estimate of -2.9, which is slightly more negative than before and still statistically significant at the 1%-level. This estimate implies that a 10 percentage point tax rate increase in affiliate's home country is related to affiliate's reported pretax profits decreasing by

29%. GDP per capita itself enters with an estimate that is not statistically different from zero.

Operating revenue is defined as revenue generated derived from the firm's primary business operations and therefore, relates to profits positively. I include operating revenue as a control variable in column 3 of Table 5. Results indicate a semi-elasticity of -2.2, that is statistically significant at the 5%-level. This semi-elasticity estimate is less negative as compared to the previous estimate. Labor and capital estimates in turn result negative and only the coefficient estimate of the labor input shows statistical significance at the 10%-level. Operating revenue itself results at 1.3, which is a large and statistically significant estimate at the 1%-level. The coefficient estimate of operating revenue implies that operating revenue is positively and quite strongly associated with profit before taxation.

Fourth specification of Table 5 includes debt ratio as a control variable instead of operating revenue. I expect the debt ratio to be negatively related to profits and thus, I include it as an additional control variable. Tax semi-elasticity experiences a change, resulting at -2.7 that is a significant estimate at the 5%-level. Also labor variable shows a positive coefficient estimate of 0.6 that is statistically significant a the 1%-level. Capital variable in turn does not receive an estimate statistically different from zero. Productivity variable shows a positive coefficient estimate of 0.4, with statistical significance at the 10%-level. Lastly, debt ratio itself enters with a large negative coefficient of -1.1 that is statistically significant at the 1%-level. This is not surprising, since calculation of profit before taxation deducts interest expenses and therefore, debt ratio is related to profit before taxation.

Last specification of Table 5, column 5, in turn includes both control variables (operating revenue and debt ratio) and results with a semi-elasticity estimate significant at the 1%-level and roughly about the size of -2.1. The estimated coefficient of operating revenue as well as debt ratio are also large and statistically significant. Interpreting the results, debt ratio seems to have a decreasing impact on profit before taxation where as operating revenue has an increasing impact. On the other hand, input variables show again negative estimates with no statistical significance. GDP per capita, proxying for productivity, shows an estimate of 0.4 that is a statistically significant estimate at 10%-level.

Altogether, the semi-elasticity results conducted with the individual affiliate data are all negative, varying from -2.1 to -2.9 that are statistically significant. These imply that a 10 percentage point increase in tax rate (for example from 20% to 30%) is associated with reported profit before taxation decreasing by 21-29%. Additionally, including operating revenue as a control variable seems to impact the results most. These results may suggest that operating revenue does not work as a good control

Table 6: Regression outputs with Panel B and profit before taxation

Dependent Variable: Log Profit before taxation					
	(1)	(2)	(3)	(4)	(5)
Tax rate	-3.279***	-3.485***	-2.644**	-3.117**	-2.414*
	(1.172)	(1.18)	(1.152)	(1.385)	(1.271)
Log labor	0.5***	0.5***	-0.182*	0.586***	-0.1
(costs of employees)	(0.075)	(0.075)	(0.094)	(0.09)	(0.122)
Log capital	0.054*	0.052*	-0.03	0.027	-0.045
(fixed tangible assets)	(0.028)	(0.028)	(0.025)	(0.032)	(0.033)
Log productivity		0.151	0.118	0.432	0.461*
(GDP per capita)		(0.224)	(0.209)	(0.269)	(0.255)
Log operating revenue			1.208***		1.24***
			(0.122)		(0.143)
Debt ratio				-0.933***	-0.949***
				(0.276)	(0.254)
Fixed effects	Firm	Firm	Firm	Firm	Firm
Observations	3,403	3,403	3,378	2,136	2,122
Number of aggregated affiliates	829	829	824	586	584
R-squared	0.628	0.625	0.723	0.599	0.715

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

variable. One reason could be the possible endogeneity rising from the fact that both profit before taxation as well as operating revenue are declared in the income statement. Further discussion and implications of these results are in Chapter 6, where I also compare these results to those with earnings before interest and taxes introduced in Chapter 5.2.

As discussed previously, aggregating affiliates of the same ultimate owner located in the same country may be beneficial since the profit shifting of a multinational is dependent on the amount of true profits it has on a country level. I use Panel B, with affiliates aggregated at country level by same ultimate owner, in the regressions reported in Table 6. Again fixed effects model is suggested by Hausman test to be preferred to a random effects model and thus, I use the fixed effects model. Now the grouping variable is the aggregated affiliate instead of individual affiliate and the heteroskedasticity robust standard errors are adjusted at the aggregated affiliate level as well. Performed F-tests on the regression specifications all suggest again

that jointly all year dummies are not different from zero, therefore I do not include year dummies. I use the same approach as with Panel A: first two regressions are formed according to the standard Hines-Rice approach and regressions 3 to 5 add control variables.

The estimated semi-elasticity in column 1 of Table 6 is about -3.3 and significant at the 1%-level. Also the input variables show positive estimates. Labor input variable results in an estimate of 0.5, statistically significant at the 1%-level. This suggests that labor input contributes again relatively more to profits before taxation, compared to the contribution of capital input that is 0.05. Including the productivity variable in column 2, the input variables are nearly unaffected: coefficient estimates as well as their standard errors remain almost invariant. In turn, tax rate estimate is more negative with an estimate of -3.5 that also has statistical significance at the level of 1%.

Column 3 of Table 6 adds an additional control variable, operating revenue, to the specification. Operating revenue enters with a coefficient estimate of 1.2 that is statistically significant at 1%-level. Inclusion of operating revenue in turn results as a semi-elasticity estimate of -2.6 significant at the 5%-level. Input variables show negative signs with only coefficient of labor resulting at a statistically significant estimate. I include debt ratio in turn as a control variable in column 4 of Table 6. Tax variable shows a more negative estimate of -3.1, with statistical significance at 5%-level. Labor, capital and productivity variables also result at positive estimates. Of these, only the estimate of labor is a statistically significant estimate (at the level of 1%) resulting at 0.6. Debt ratio itself again enters the regression with a negative and large estimate of -0.9 that is also statistically significant at the 1%-level.

Final regression of Table 6, column 5, includes both operating revenue and debt ratio as control variables. This specification results at a semi-elasticity estimate of -2.4 statistically significant at 10%-level. This estimate is less negative as compared to regressions with only one of the control variables included (columns 3 and 4). Operating revenue shows a positive coefficient estimate of 1.2 which is statistically significant at 1%-level. Debt ratio results at an almost similar estimate and standard error as in column 4. Labor and capital variables in turn do not show statistically significant estimates in column 5. GDP per capita in turn results at an estimate of 0.5, statistically significant at the 10%-level. By briefly summarizing the results of Table 6, we can notice that the results are in line with Panel A results. Again, all regression specifications result in a negative semi-elasticity estimate as would be expected according to the theory of profit shifting. The semi-elasticity estimate with Panel B ranges between -2.4 and -3.5. I provide further discussion and comparison between the panels in Chapter 6.

Table 7: Regression outputs with Panel C and profit before taxation

Dependent Variable: Log Profit before taxation				
	(1)	(2)	(3)	(4)
Tax rate	-7.384**	-7.394**	-4.819*	-5.517**
	(2.911)	(2.824)	(2.549)	(2.455)
Log labor	1.152***	1.151***		
(costs of employees)	(0.371)	(0.381)		
Log labor			0.082***	0.096***
(number of employees)			(0.023)	(0.033)
Log capital	-0.281	-0.281	0.172	0.151
(fixed tangible assets)	(0.18)	(0.18)	(0.135)	(0.137)
Log productivity		0.006		0.547
(GDP per capita)		(0.819)		(0.559)
Fixed effects	Country	Country	Country	Country
Observations	168	168	175	175
Number of countries	36	36	38	38
R-squared	0.579	0.579	0.444	0.552

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Table 7 introduces results that are regressed in turn with the last data set, Panel C. As the data set consists of affiliates aggregated on a country level, they are more comparable to the results received in earlier literature. Additionally, these aggregated country level results present how results change compared to the individual affiliate level data. Hausman test again prefers fixed effects model to random effects model, thus I use the fixed effects model. All regressions include country fixed effects and heteroskedasticity robust standard errors adjusted for country clusters are given in parentheses. Again I do not include year dummies, as the results from F-tests suggest that time fixed effects are not needed.

At first, we can see that the tax rate coefficient estimates as well as the standard errors in Table 7 have increased substantially. The estimated semi-elasticity in the first column is about -7.4 and statistically significant at 5%-level. Compared to the semi-elasticity estimate of -2.8 in a similar regression with Panel A, the estimate more than doubles. Labor input also results with a large estimate of 1.2, that is statistically significant at 1%-level. On the other hand, capital variable does not show a statistically significant estimate. Turning to column 2, I include the

productivity variable in the specification. This modification does very little to the estimates and standard errors of the other variables. Productivity itself enters with an estimate that is not statistically different from zero.

As debt ratio and operating revenue are affiliate level controls, using them at the country level is not meaningful. Instead, I introduce specifications in columns 3-4 of Table 7, which use number of employees instead of costs of employees as proxy for labor input. Hines and Rice (1994) use number of employees in their estimation, and to be able to compare my results to those of Hines and Rice (1994), I also run the regressions here with using number of employees instead of costs. As their capital input variable they use a measure of plant, property and equipment which should be quite corresponding to the fixed tangible assets variable. Specification of column 3 results with a semi-elasticity of about -4.8, that is statistically significant only at the 10%-level. The semi-elasticity is considerably less negative compared to the semi-elasticity estimate of -7.4 derived with costs of employees. In addition, the labor input variable experiences an even larger decrease, resulting with an estimate of 0.08 that is statistically significant at the 1%-level. Again, capital input does not show a statistically significant estimate.

Including GDP per capita as the productivity proxy in the specification in column 4 of Table 7 alters the estimates slightly. First of all, the tax variable shows a more negative estimate at -5.5, with higher statistical significant at the 5%-level. Compared to the results of column 3, the estimate of semi-elasticity is more negative while the standard error has decreased. The labor input, number of employees, results again at a relatively small estimate of 0.1 that is statistically significant at the 1%-level. Capital input and productivity variables in turn do not show statistically significant estimates. All in all, the results with country level data differ considerably from the results with Panels A and B. The semi-elasticity estimates are substantially more negative, but at the same time standard errors have increased which results as decreased statistical significance. The semi-elasticity estimates with Panel C range from -4.8 to -7.4, suggesting that a 10 percentage point increase in tax rate is related to decreasing profit before taxation of 48-74%. Also the number of observations presumably is much smaller, which has its impact on the results. Chapter 6 provides more comparison between panels and suggestions for why these differences between panels emerge.

5.2 Robustness checks

In this chapter, I provide several alternative regressions as additional robustness checks. All of the regressions, that I introduce in this chapter are derived with the

Table 8: Additional regression outputs with EBIT

Dependent Variable: Log Earnings before interest and taxes					
	(1)	(2)	(3)	(4)	(5)
Tax rate	-2.143**	-2.283**	-1.593*	-1.438	-0.903
	(0.964)	(0.955)	(0.869)	(1.124)	(1.047)
Log labor	0.594***	0.593***	-0.158	0.599***	-0.203
(costs of employees)	(0.079)	(0.079)	(0.1)	(0.105)	(0.136)
Log capital	0.044*	0.043*	-0.021	0.035	-0.017
(fixed tangible assets)	(0.023)	(0.023)	(0.02)	(0.027)	(0.023)
Log productivity		0.112	0.111	0.41**	0.38**
(GDP per capita)		(0.178)	(0.164)	(0.202)	(0.189)
Log operating revenue			1.203***		1.232***
			(0.095)		(0.121)
Debt ratio				-0.601***	-0.577***
				(0.214)	(0.19)
Fixed effects	Firm	Firm	Firm	Firm	Firm
Observations	4,371	4,371	4,343	2,927	2,910
Number of affiliates	1,078	1,078	1,073	774	771
R-squared	0.611	0.607	0.732	0.578	0.725

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

affiliate level data, Panel A (excluding the regressions of the last Table 15). First, I begin by introducing similar regressions as in Table 5 but with earnings before interest and taxes (EBIT) as the dependent variable. To be able to assess the importance of debt-shifting as a channel of profit shifting, I need the regressions with EBIT as the dependent variable for the comparison. Additionally, the regressions work as a confirmation that the chosen pretax profit measure does not drive the results. I present the results for the alternative profit measure in Table 8 with heteroskedasticity robust standard errors in parentheses. Again, according to Hausman test fixed effects model is preferred to a random effects model. I do not include year dummies, since F-tests produced on all regression specifications suggest that time fixed effects are not needed.

Columns 1 and 2 of Table 8 are formed again according to the standard Hines-Rice approach. First specification results with significant estimates for all coefficients. The estimated semi-elasticity is about -2.1 and statistically significant at the 5%-level in column 1. Comparing the results of columns 1 of Tables 5 and 8 to each other, the input variables show almost equal coefficient estimates and standard errors while the tax semi-elasticity estimate is less negative with EBIT. Actually, all semi-elasticity estimates of Table 8 with EBIT as dependent variable are less negative than the semi-elasticity estimates of corresponding regressions with profit before taxation in Table 5. This is what would be expected, since profit before taxation also includes the debt-shifting channel. Chapter 6 further presents the comparison between results derived with different dependent variables and the implications it may have.

After including the productivity variable, log of GDP per capita, in column 2 of Table 8 the semi-elasticity estimate is slightly more negative with a semi-elasticity estimate of -2.3. Additionally, capital and input coefficient estimates do not seem to experience almost any kind of changes compared to column 1. According to these estimates, the contribution of labor input to earnings before interest and taxes seems to be more important compared to that of capital input. Productivity variable on the other hand does not enter with a statistically significant estimate. Column 3 includes the logarithm of operating revenue as a control variable. The estimated semi-elasticity is now -1.6 with statistical significance at the 10%-level. In addition, labor, capital and productivity variables do not show estimates that are statistically different from zero. Operating revenue itself enters with an estimate of 1.2 significant at the 1%-level.

Turning to columns 4 and 5 of Table 8, debt ratio is included as additional affiliate level control. Column 5 includes both controls (operating revenue and debt ratio) whereas column 4 includes only debt ratio. Entering debt ratio has a substantial

Table 9: Additional regression outputs with different input proxies

Dependent variable: Log Profit before taxation						
	(1)	(2)	(3)	(4)	(5)	(6)
Tax rate	-2.89***	-2.156**	-3.253***	-2.19**	-2.556**	-2.103*
	(1.071)	(0.999)	(0.978)	(1.079)	(0.999)	(1.084)
Log labor	0.591***	0.324***	0.553***			
(costs of employees)	(0.079)	(0.093)	(0.088)			
Log labor				0.199***	0.094**	0.198***
(number of employees)				(0.051)	(0.042)	(0.047)
Log capital	0.043*			0.07**		
(fixed tangible assets)	(0.025)			(0.033)		
Log capital		0.596***			0.64***	
(total assets)		(0.167)			(0.123)	
Log capital			0.039			0.053*
(fixed assets)			(0.025)			(0.029)
Log productivity	0.078	0.133	0.204	0.236	-0.173	0.268
(GDP per capita)	(0.197)	(0.176)	(0.194)	(0.185)	(0.121)	(0.182)
Fixed effects	Firm	Firm	Firm	Firm & time	Firm	Firm & time
Observations	4,371	4,993	4,573	5,600	6,368	5,866
Number of groups	1,073	1,194	1,120	1,450	1,612	1,520
R-squared	0.585	0.744	0.571	0.532	0.749	0.555

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

impact on the estimates. Tax semi-elasticity estimates are no longer statistically different from zero in either regressions. These results may suggest that debt ratio and operating revenue may not work as control variables for EBIT in the same way they worked for profit before taxation. The statistically significant semi-elasticity estimates of Table 8 suggest that a 10 percentage point increase in tax rate is associated with reported EBIT decreasing by 16-23%. Again, the results including operating revenue as a control variable differ (columns 3 and 5) from the other results.

The data source provides many alternatives to use as proxies for capital and labor input. Table 9 presents results with profit before taxation as the dependent

variable with varying labor and capital input proxies. Again, these alternative input measures function as robustness checks to confirm that the chosen main input measures do not have any remarkable effects on the derived results. I control for firm fixed effects in all regressions but include time fixed effects in only those specifications where the result of a F-test suggests so. Columns 1 is repetition of column 2 of Table 5 derived with the main capital and input proxies to make the comparison of the alternative proxies more convenient. Columns 2 and 3 use the same labor input as before, costs of employees, but include different capital proxies.

Column 2 uses total assets as the capital input variable instead of the usual fixed tangible assets and does not include year dummies. The estimated semi-elasticity now is about -2.2, statistically significant at 5%-level. This is in line with the results introduced in Chapter 5.1. Total assets shows a positive estimate of 0.6, significant at the 1%-level. This estimate is much larger as compared to the estimates derived with fixed tangible assets as capital input variable, usually around 0.04. On the other hand this finding is not that surprising, as total assets contains all assets of the company (including fixed tangible assets as well). The coefficient of labor input in turn is smaller than before, with an estimate of 0.3 statistically significant at 1%-level. These imply that capital input contributes more to profit before taxation compared to labor, in contrary to results received earlier. Column 3 uses fixed assets as the capital input proxy and does not include time fixed effects. This results in a semi-elasticity estimate of -3.3, that is statistically significant at the 1%-level. Labor input results at a statistically significant estimate of 0.6, equivalent to the results with the main proxies, i.e. column 1. Fixed assets itself does not enter with a statistically significant results. Comparing to column 1, using fixed assets shows input coefficients near to those derived with main input proxies. The semi-elasticity estimate in turn is more negative.

Columns 4 to 6 of Table 9 in turn provide results with number of employees as the proxy for affiliate's labor input. Column 4 introduces a specification with using the main capital input proxy, fixed tangible assets, and number of employees as the labor input proxy. In contrary to previous specifications, column 4 includes year dummies since the performed F-test suggests that time fixed effects should be included (i.e. null hypothesis that year dummies are jointly equal to zero can be rejected). The estimated semi-elasticity now is about -2.2, with statistical significance at the 5%-level. Also both input variables result with statistically significant estimates: labor input with an estimate of 0.2 and capital input with an estimate of 0.07. Compared to the basic specification, column 1, the semi-elasticity estimate is less negative and the contribution of labor has decreased to about one third of the previous estimate of 0.6.

I use total assets again as an alternative input proxy with number of employees in column 5 of Table 9. F-test suggests that time fixed effects are not needed, and thus I do not include year dummies in column 5. Using number of employees and total assets result again in a negative and statistically significant semi-elasticity estimate of -2.6. Total assets itself enters with a large estimate of 0.6, statistically significant at the 1%-level. Estimated labor input, number of employees, coefficient in turn halves to 0.1 when using total assets as the capital proxy. The coefficient estimate of the number of employees still is statistically significant at the 5%-level.

Lastly, column 6 of Table 9 introduces results with number of employees and fixed assets as proxies for labor and capital input. F-test again suggests that time fixed effects are needed as the null hypothesis that year dummies are jointly equal to zero can be rejected. Thus, column 6 controls for both, firm and time fixed effects. Tax variable now results with an estimate of -2.1, statistically significant only at the 10%-level. Number of employees, labor input, shows an estimate of 0.2 with statistical significance at the 1%-level. Fixed assets enters with a coefficient estimate of 0.05, statistically significant at the 10%-level. All in all, results of Table 9 seem to confirm further my main results and indicate that the chosen main input measures should not have a confounding effect on the results. Most importantly, the estimated tax semi-elasticity is negative and ranges roughly at the same estimates as in Table 5, between -2.1 and -3.3. These suggest that a 10 percentage point increase in tax rate is related to reported profit before taxation decreasing by 21-33%.

As discussed in Chapter 4.3, using statutory tax rates as the tax incentive variable has its limits. Therefore, Table 10 introduces results derived also with using the average effective tax rate (AETR) as indicating the tax incentive for profit shifting. As the data for average effective tax rates is only available for the year 2017, I perform the regressions with a cross-section of the data for year 2017. Thus, the number of observations is substantially smaller compared to previous regressions. This also means that I cannot include affiliate fixed or time fixed effects in the regressions. In turn, I introduce industry dummies to control for industry-specific effects. Industry dummies are at the 2-digit NACE industry code level and the table does not report corresponding coefficient estimates.

Columns 1 and 2 of Table 10 use AETR to proxy for the tax incentive of profit shifting. First column is again the basic specification without productivity or additional control variables included. The estimated tax semi-elasticity is now -2.3 that is statistically significant at the 1%-level. Also the capital and labor input variables result with positive and statistically significant estimates at the 1%-significance level. Costs of employees shows an estimate of 0.2, whereas total assets shows an estimate of 0.7. This suggests that capital contributes more to profit before taxation than

Table 10: Additional regression outputs with AETR and 2017

Dependent variable: Log Profit before taxation				
	(1)	(2)	(3)	(4)
Tax rate (average effective)	-2.342*** (0.717)	-1.718*** (0.749)		
Tax rate (statutory)			-3.012*** (0.732)	-2.308*** (0.821)
Log labor (costs of employees)	0.223*** (0.076)	0.075 (0.061)	0.225*** (0.076)	0.077 (0.061)
Log capital (total assets)	0.72*** (0.077)	0.573*** (0.06)	0.719*** (0.076)	0.577*** (0.061)
Log productivity (GDP per capita)		-0.159** (0.073)		-0.127* (0.075)
Log operating revenue		0.353*** (0.076)		0.346*** (0.076)
Debt ratio		-0.567*** (0.187)		-0.569*** (0.182)
Industry dummies	No	Yes	No	Yes
Observations	851	525	851	525
R-squared	0.749	0.845	0.75	0.846

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

labor input does. In all the specifications of Table 10 capital proxy in use is total assets instead of fixed tangible assets. Using fixed tangible assets did not result in any meaningful estimates and thus, total assets is used instead. This should not be a huge problem in the comparison as the results of Table 9 suggest that semi-elasticity estimate with total assets actually showed less negative compared to the use of fixed tangible assets.

Turning to column 2 of Table 10, I include to the specification also the productivity variable as well as all control variables, that are operating revenue, debt ratio and industry dummies. Now the tax semi-elasticity results less negative, with an estimate of -1.7 that is statistically significant at the 1%-level. Labor input does not result in a significant estimate. In turn, capital input shows an estimate of 0.6, statistically significant at the 1%-level. Additionally, productivity, operating revenue and debt ratio all enter with statistically significant estimates. Productivity as well as debt ratio show negative estimates of -0.2 and -0.6 respectively. Operating revenue results with an estimate of about 0.4.

The statutory tax rate, CIT rate, is used in columns 3 and 4 of Table 10 in order to ease the comparison between different tax variables. We can see that the results derived with AETR and CIT rate are similar to each other. The largest difference though is in the semi-elasticity estimates where the estimates derived with CIT rate are more negative. I further compare and discuss the results in Chapter 6. Column 3 again is in the form of the very basic regression specification. Tax rate variable results with a coefficient estimate of -3, suggesting that a 10 percentage point tax rate increase is related to reported profit before taxation decreasing 30%. Labor input shows again an estimate of 0.2 and capital input an estimate of 0.7. The estimates of column 3 are also all statistically significant at the 1%-level.

Last column of Table 10 includes all control variables. This inclusion in turn affects the estimated semi-elasticity, resulting with a less negative estimate of -2.3 that is still statistically significant at the 1%-level. Labor input on the other hand does not show a statistically significant estimate whereas capital input results with a statistically significant estimate of 0.6, that is slightly smaller than in the previous specification. Operating revenue in turn shows a highly statistically significant estimate of 0.3. Again, productivity and debt ratio enter with negative estimates of -0.1 and -0.6 respectively. The statistical significance of the productivity estimate is only at the 10%-level whereas debt ratio estimate is statistically significant at the 1%-level. To conclude on Table 10, cross-sectional regressions with AETR suggest that a 10 percentage point increase in AETR is related to profits before taxation decreasing by 17-23%. In turn, a 10 percentage point increase in CIT rate is associated with 23-30% decreased reported profit before taxation. These suggest

Table 11: Additional regression outputs with per employee

Dependent variable:	Log PBT per employee		Log EBIT per employee	
	(1)	(2)	(3)	(4)
Tax rate	-2.331**	-2.16**	-1.826*	-1.668*
	(0.86)	(0.967)	(0.987)	(0.981)
Log labor (costs of employees per employee)	0.86***	0.867***	0.853***	0.86***
	(0.076)	(0.076)	(0.071)	(0.071)
Log capital (fixed tangible assets per employee)	0.033	0.035	0.037	0.038
	(0.028)	(0.028)	(0.025)	(0.025)
Log productivity (GDP per capita)		-0.365		-0.336
		(0.457)		(0.222)
Fixed effects	Firm	Firm	Firm	Firm
Observations	3,806	3,806	3,806	3,806
Number of groups	1,021	1,021	1,021	1,021
R-squared	0.129	0.122	0.136	0.133

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

that even using the other tax rate variable gives negative semi-elasticity estimates, though slightly less negative as compared to the main tax variable.

Table 11 in turn presents regression outputs with the proxies adjusted to per employee level. The reasoning behind this is that adjusting the firm accounting data to per employee level may indicate something about the size of the affiliate. Columns 1 and 2 use profit before taxation (PBT) per employee as the dependent variable whereas columns 3 and 4 use earnings before interest and taxes (EBIT) per employee. I do not include year dummies in any of the regressions, as all F-tests suggest that time fixed effects are not needed. First column results with a semi-elasticity estimate of -2.3, suggesting that a tax rate increase by 10 percentage points (i.e. from a tax rate of 10% to 20%) is associated with a 23% decrease in reported profit before taxation per employee. The estimate of tax rate is statistically significant at the 5%-level. Also the labor proxy, costs of employees per employee, shows a highly statistically significant estimate of 0.9. Capital variable, fixed tangible assets per employee, in turn does not result in a statistically significant estimate. Column 2 of Table 11 adds again the productivity variable, GDP per capita, to the specification.

Productivity itself enters the specification with a statistically insignificant estimate. Additionally, capital and labor variables do not experience nearly any changes in the estimates nor their standard errors as compared to those of column 1. Now, the estimated tax incentive variable is -2.2, that is almost similar to the estimate of column 1. Again, the estimate is also statistically significant at the 5%-level. Concluding on the profit before taxation per employee part, the tax semi-elasticity estimates of -2.3 and -2.2 yet confirm my main results.

Turning to the regressions with EBIT per employee as the dependent variable, columns 3 and 4 of Table 11, the semi-elasticity estimates are less negative. Starting with column 3, the estimated semi-elasticity is about -1.8, statistically significant only at the 10%-level. Labor input results in an estimate of 0.9, that is statistically significant at the 1%-level, whereas capital input does not show a statistically significant estimate. Column 4 again introduces GDP per capita as the proxy for productivity. GDP per capita enters with a statistically insignificant estimate. Tax semi-elasticity results now with an estimate of -1.7 that is statistically significant at the 10%-level. Labor and capital input do not experience nearly any changes in their estimates or standard errors. The estimates of tax semi-elasticity with EBIT per employee are -1.8 and 1.7, falling in the same range as estimated in Table 8.

Comparing columns with the different profit per employee proxies of Table 11, profit before taxation per employee result in more negative estimates than EBIT per employee. This is in line with the theory as the argument is that profit before taxation should result in more negative estimates as it includes profit shifting executed through all channels. Additionally, capital, labor and productivity proxies all result in almost identical coefficient estimates. One surprising fact compared to previous results, is the negative sign that GDP per capita estimate shows. On the other hand, the estimate is statistically insignificant in both regressions (columns 2 and 4), thus should not be that worrying.

Moving to additional regressions with alternative sample restrictions, Table 12 starts by introducing results with two different samples of the data. Columns 1 and 2 include those affiliates that have a lower home country tax rate as the parent (i.e. Finland) has. I refer to these as the low tax affiliates. In other words, these affiliates face a negative tax differential, since their home country tax rate deducted by Finland's tax rate is negative. Columns 3 and 4 in turn include those affiliates with a positive tax differential, i.e. those affiliate's that have a higher home country tax rate compared to the tax rate of Finland. I refer to these in turn as the high tax affiliates. This division is done to see whether the semi-elasticity estimates between these country groups differ significantly. All specifications of Table 12 control for firm fixed effects.

Table 12: Additional regression outputs with low and high tax affiliates

Dependent variable: Log Profit before taxation				
	Low tax affiliates		High tax affiliates	
	(1)	(2)	(3)	(4)
Tax rate	-3.937**	-3.919**	-2.259*	-2.682**
	(1.731)	(1.738)	(1.161)	(1.176)
Log labor	0.485***	0.477***	0.624***	0.625***
(costs of employees)	(0.113)	(0.111)	(0.105)	(0.105)
Log capital	0.167***	0.165***	-0.004	-0.006
(fixed tangible assets)	(0.05)	(0.05)	(0.029)	(0.028)
Log productivity		0.318		0.202
(GDP per capita)		(0.437)		(0.225)
Fixed effects	Firm	Firm	Firm	Firm
Observations	1,340	1,340	3,031	3,031
Number of groups	595	595	868	868
R-squared	0.598	0.585	0.59	0.583

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Starting with columns 1 and 2 of Table 12, I introduce regressions with the low tax affiliates. Column 1 results with a tax semi-elasticity estimate of -3.9, that is statistically significant at the 5%-level. Both input variables result at estimates that are statistically significant at the 1%-level, labor with an estimate of 0.5 and capital with 0.2. Column 2 includes also the productivity variable, resulting again with a semi-elasticity estimate of -3.9 that is statistically significant at the 5%-level. Input variables in turn remain nearly equal whereas productivity enters with a large but statistically insignificant estimate. All in all, the results with low tax affiliates suggest that a 10 percentage point increase in tax rate is associated with profit before taxation declining by 39%. Additionally, labor seems to contribute over twice more to profit before taxation as capital does.

Columns 3 and 4 of Table 12 in turn provide the results with the high tax affiliates. I do not include year dummies as the F-tests suggest that controlling for time fixed effects is not needed. Column 3 shows a semi-elasticity estimate of -2.3, that is statistically significant at the 10%-level. Labor input results in an estimate of 0.6 that is statistically significant at the 1%-level. Capital input does not show an estimate statistically different from zero. Column 4 introduces productivity to the specification. Labor input as well as capital input do not experience any remarkable changes compared to column 3. Estimated tax semi-elasticity in column 4 is now -2.7, statistically significant at the 5%-level. Productivity enters again with a statistically insignificant estimate. The results of columns 3 and 4 indicate that a tax rate increase of 10 percentage points is related to reported profit before taxation of high tax affiliates decreasing by 23-27%. The semi-elasticity estimates of -2.3 and -2.7 are less negative as compared to the semi-elasticity estimates of columns 1 and 2, derived with the low tax affiliate sample. On the other hand, the difference between the semi-elasticity estimates is not statistically significant and the confidence interval includes zero, thus we cannot rule out that the difference is equal to zero. Interestingly, also input estimates are different: capital input seems to contribute more to profit before taxation in low tax countries as compared to high tax countries whereas the situation is vice versa for the labor input. Of these, the difference between the estimates of labor input is statistically significant at the 5%-level and the 95%-confidence interval does not include zero, suggesting that there is a difference between these groups in terms of the labor input estimates. I further discuss the implications these findings may have in Chapter 6.

Table 13 introduces additional regressions derived with different sample restrictions on the data. These are done in order to find out if there are any suggestions of a specific group being relatively more or less involved in profit shifting activities. I exploit three samples for these additional regressions. First sample includes only

Table 13: Additional regression outputs with different sample restrictions

Dependent variable:	Log Profit before taxation			Log Earnings before interest and taxes		
	(1)	(2)	(3)	(4)	(5)	(6)
Tax rate	-3.891**	-2.546**	-3.277**	-3.306*	-2.02*	-2.38**
	(1.759)	(1.173)	(1.304)	(1.8)	(1.153)	(1.306)
Log labor	0.707***	0.704***	0.61***	0.663***	0.73***	0.63***
(costs of employees)	(0.155)	(0.111)	(0.125)	(0.163)	(0.107)	(0.128)
Log capital	0.104	0.001	0.013	0.106	-0.016	0.005
(fixed tangible assets)	(0.067)	(0.03)	(0.035)	(0.067)	(0.027)	(0.034)
Log productivity	0.576	0.005	0.103	0.191	0.2	0.228
(GDP per capita)	(0.45)	(0.25)	(0.246)	(0.414)	(0.219)	(0.205)
Sample	Manufacturing affiliates	Western Europe affiliates	Big Four audit clients	Manufacturing affiliates	Western Europe affiliates	Big Four audit clients
Fixed effects	Firm	Firm	Firm	Firm	Firm	Firm
Observations	1,220	2,500	2,072	1,220	2,500	2,072
Number of groups	283	620	483	283	620	483
R-squared	0.67	0.552	0.433	0.721	0.558	0.431

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

manufacturing affiliates, i.e. those affiliates that have a NACE 2-digit sector code that is classified under manufacturing activities. Second sample includes only those affiliates that are located in Western Europe countries. The purpose is to compare if the semi-elasticity estimate derived with only Western Europe affiliates is different from the semi-elasticity estimate derived with all sample country affiliates included. Appendix A.1 lists the countries classified as Western European countries within this sample. Last sample includes only those affiliates that have a Big Four company listed as their auditor. Idea is to test if the semi-elasticity estimates with Big Four audit clients are substantially different from those semi-elasticity estimates derived with all affiliates. If the estimates are substantially more negative with only Big Four audit clients, this may suggest that these affiliates tend to shift their profits relatively more.

Table 13 is composed in the following way. Columns 1 to 3 use profit before taxation as the dependent variable whereas columns 4 to 6 use earnings before interest and taxes (EBIT). I implement columns 1 and 4 with the sample of manufacturing affiliates, columns 2 and 5 with Western Europe affiliates and columns 3 and 6 with Big Four audit client affiliates. The respective sample is presented in the table as well. All regressions are in the form of the basic Hines-Rice approach, i.e. including also the productivity variable, GDP per capita. I do not include time dummies in any specification as all F-tests suggest that no time fixed effects are needed.

Starting with the sample of manufacturing affiliates, the sample consists of 283 affiliates. Column 1 of Table 13 uses profit as dependent variable and results with a tax semi-elasticity estimate of -3.9 that is statistically significant at the 5%-level. Also labor results with a statistically significant estimate at the 1%-level, resulting at 0.7. In turn the estimates of capital and productivity variable do not show statistical significance. Column 4, using EBIT as dependent variable, results with a semi-elasticity estimate of -3.3 that is statistically significant at the 10%-level. This estimate is less negative compared to the semi-elasticity estimate of column 1. Again, labor also results with a statistically significant estimate of 0.7 whereas productivity and capital variable do not show statistically significant estimates.

Turning to those affiliates based in Western Europe countries, the sample includes 620 affiliates. Column 2 of Table 13 results with an estimate of -2.5 using profit before taxation as the proxy for pretax profits. The estimate is also statistically significant at the 5%-level. Labor input results a coefficient estimate of 0.7 that is statistically significant at the 1%-level. Productivity and capital variables again do not show statistically significant estimates. I use EBIT in turn in column 5 with the Western Europe affiliate sample. This on the other hand results with a tax semi-elasticity estimate of -2 that is only significant at the 10%-level. Again,

Table 14: Additional regression outputs with balanced panel

Dependent variable: Profit before taxation		
	(1)	(2)
Tax rate	-2.467**	-2.598**
	(1.18)	(1.156)
Log labor	0.802***	0.797***
(costs of employees)	(0.101)	(0.104)
Log capital	0.042	0.042
(fixed tangible assets)	(0.03)	(0.028)
Log productivity		0.144
(GDP per capita)		(0.401)
Fixed effects	Firm & time	Firm & time
Observations	2,076	2,076
Number of groups	346	346
R-squared	0.599	0.598

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

the semi-elasticity is less negative as compared to the result derived with profit before taxation. Of the other variables in column 5, only labor shows a statistically significant estimate of 0.7.

Lastly, the sample consisting only of Big Four audit clients include 483 affiliates. Table 13 introduces results with this sample in columns 3 and 6. Column 3 using profit before taxation as the dependent variable shows a semi-elasticity estimate of about -3.3 that is statistically significant at the 5%-level. As with the other samples, labor is the only one of the control variables resulting with a statistically significant estimate. Now, the estimate results at 0.6. Using EBIT as the proxy for pretax profit in column 6, the tax semi-elasticity estimate is about -2.4 that is statistically significant also at the 5%-level. Again, also labor input results in an estimate of 0.6 that is statistically significant at the 1%-level. Productivity or capital input variables do not result in estimates that are statistically significantly different from zero. Chapter 6 provides further discussion of the implications these results may have.

Finally, I provide some additional regressions to test the features of the data sample. Table 14 provides the main regressions run with balanced data to see if the results differ substantially form those derived with an unbalanced data (i.e. the main

regressions). Balanced data means that each firm included in the sample is observed for every period. The restriction of balanced panel has its effect on the sample size, as only 346 firms report the needed accounting data (profit before taxation, costs of employees and fixed tangible assets) for all 6 years. In addition to firm fixed effects, also time fixed effects are controlled for as the performed F-tests suggest that year dummies should be included (i.e. the null hypothesis that all year dummies are jointly equal to zero can be rejected in both specifications).

Both specifications of Table 14 are in the form of the standard Hines-Rice approach, with no additional control variables included. Column 1 shows a negative tax semi-elasticity estimate of -2.5, that is statistically significant at the 5%-level. Labor input results with a highly significant estimate of 0.8, whereas capital input does not result with an estimate statistically indifferent from zero. Column 2 in turn includes the productivity variable to the specification. The coefficient estimates and standard errors of the input variables remain nearly unaffected. The semi-elasticity in column 2 results at -2.6 that is statistically significant again at the 5%-level. Productivity itself enters with an estimate that is not statistically indifferent from zero. These may suggest that labor input contributes to profit before taxation as capital input does. The semi-elasticity estimates of -2.5 and -2.6 indicate that a tax rate increase of 10 percentage points is related to reported profit before taxation decreasing by 25-26%. To conclude on Table 14, the results further confirm my main results with the unbalanced data and suggest that using an unbalanced data instead of a balanced data should not have a substantial impact on the results.

In contrary to the previous regressions of this chapter, Table 15 provides regressions with Panel C, that is the data aggregated at the country level. However, the data used in this table is aggregated after I have excluded the zero and negative observations. This on the other hand means that Panel A and Panel C will now consist of the exactly same observations. I name this data as modified Panel C. I control for country fixed effects in all the specifications whereas all the performed F-tests suggest that time fixed effects are not needed. As before, heteroskedasticity robust standard errors are given in parentheses.

Columns 1 and 2 use costs of employees as the labor proxy while columns 3 and 4 exploit number of employees. First column of Table 15 shows a semi-elasticity of -2.7 that is statistically significant at the 5%-level. Labor input does not show an estimate statistically different from zero. Capital input results at an estimate of 0.2 that is statistically significant only at the 10%-level. Column 2 of Table 15 includes also the productivity variable resulting with an estimated semi-elasticity of -2.7, statistically significant only at the 10%-level. The other variables of column 3 do not show statistically significant coefficient estimates. The estimates are substantially

Table 15: Additional regression outputs with modified Panel C

Dependent Variable: Log Profit before taxation				
	(1)	(2)	(3)	(4)
Tax rate	-2.73**	-2.666*	-3.042*	-3.209*
	(1.185)	(1.4)	(1.683)	(2.455)
Log labor	0.358	0.36		
(costs of employees)	(0.227)	(0.381)		
Log labor			0.044	0.049
(number of employees)			(0.038)	(0.034)
Log capital	0.19*	0.191	0.372***	0.364***
(fixed tangible assets)	(0.111)	(0.113)	(0.111)	(0.117)
Log productivity		-0.06		0.179
(GDP per capita)		(0.594)		(0.461)
Fixed effects	Country	Country	Country	Country
Observations	190	190	197	197
Number of countries	36	36	38	38
R-squared	0.755	0.744	0.712	0.75

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

different from those provided with the original Panel C in Table 7. Comparing to the semi-elasticity estimates with the original Panel C, which are over 2.5-times more negative than these estimates derived with this modified Panel C.

I use number of employees as the labor proxy in columns 3 and 4 of Table 15. This adjustment somewhat modifies the coefficient estimates. Starting from column 3, the estimated semi-elasticity of -3 is statistically significant only at the 10%-level. Labor input again does not result with a statistically significant estimate whereas the capital input results now at a highly significant estimate of 0.4. Column 4 again includes the productivity variable. The estimated semi-elasticity is now about -3.2, statistically significant at the 10%-level. The input variables and their standard errors do not experience any substantial changes compared to column 3. Again, comparing these results to those with the original Panel C, that is Table 7, the estimates are slightly different. Where the estimated semi-elasticities with the original Panel C are -4.8 and -5.5, the respective results with the modified Panel C are -3 and -3.2. Additionally, original Panel C shows statistically significant estimates for labor input but not for capital input, whereas the situation is the vice versa for the modified Panel C. I will discuss these differences and their implications further in Chapter 6.

5.3 Implications of the 2014 tax rate change

As the corporate income tax rate in Finland changed in 2014 from 24.5% to 20%, studying the possible effects it had on profit shifting is of special interest. This tax rate decrease can be seen as quite large, as the decrease was almost one-fifth of the previous rate. To identify if there has been changes in the profit shifting behavior after 2014, Table 16 introduces results derived with two cross-sections of the data, with years 2012 and 2017. That is the first and last year of the data available, i.e. 2012 is assumed to capture the profit shifting activity associated with the higher tax rate whereas 2017 captures the scale of profit shifting associated with the lowered tax rate. By comparing the results of the two years to each other, we may be able to assess if there are large differences between the semi-elasticity estimates. Again, since the data in use is a cross-section, I cannot include any fixed effects. Additionally, I use EBIT as the dependent variable in all the results introduced in Table 16. This is because with profit before taxation as the dependent variable I did not find any significant results.

Columns 1 and 2 of Table 16 use the cross-sectional data from year 2012 with 735 affiliates in the sample. First column does not include any additional control variables and thus, is formed according to the basic Hines-Rice approach. This

Table 16: Additional regression outputs with cross-section 2012 and 2017

Dependent variable: Log Earnings before interest and taxes				
	Year 2012		Year 2017	
	(1)	(2)	(3)	(4)
Tax rate	-2.713**	-2.929**	-1.846*	-1.745*
	(1.253)	(1.355)	(1.041)	(0.979)
Log labor	0.622***	0.618***	0.595***	0.646***
(costs of employees)	(0.042)	(0.047)	(0.038)	(0.036)
Log capital	0.225***	0.216***	0.226***	0.198***
(fixed tangible assets)	(0.026)	(0.031)	(0.024)	(0.026)
Log productivity	0.186*	0.118	0.138	-0.004
(GDP per capita)	(0.103)	(0.109)	(0.089)	(0.083)
Industry dummies	No	Yes	No	Yes
Observations	735	733	734	733
R-squared	0.643	0.696	0.663	0.733

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

results with a semi-elasticity estimate of -2.7 that is statistically significant at the 5%-level. Also all other variables of the specification show statistically significant estimates. Labor and capital estimates are both statistically significant at the 1%-level with estimates about 0.6 and 0.2 respectively. The productivity variable results with a coefficient estimate of about 0.2, statistically significant only at the 10%-level. Turning to column 2, I add industry dummies to control for industry specific effects. This inclusion in turn results with a slightly more negative estimated tax semi-elasticity of -2.9 that is statistically significant at the 5%-level. Capital and labor coefficients or standard errors remain almost unchanged whereas productivity variable does not result in a statistically significant estimate.

I use the cross-section of 2017 with 734 affiliates in the columns 3 and 4 of Table 16. Column 3 does not include any control variables, resulting with a semi-elasticity estimate of -1.8 that is statistically significant only at the 10%-level. Labor and capital input estimates are similar to those derived with the 2012 sample: labor with an estimate of 0.6 and capital with 0.2, both statistically significant at the 1%-level. Productivity does not show any statistically significant estimate in column 3. Industry dummies are again included in column 4, resulting with a semi-elasticity estimate of -1.7. The estimate is significant only at the 10%-level. Capital and labor

input variables experience minor changes but nothing substantial. Productivity again does not result with any statistically significant estimate.

Comparing the estimates between the samples of 2012 and 2017, the semi-elasticity estimates with 2012 sample are more negative with estimates of -2.7 and -2.9. These suggest that a 10 percentage point increase in home country tax rate is associated with 27-29% decreased reported EBIT of affiliates in that country. At the same time the tax semi-elasticity estimates with 2017 sample are -1.8 and -1.7, indicating that a 10 percentage point increase in tax rate is related to a 17-18% decrease in reported EBIT. Also the estimates of capital and labor inputs are quite similar in all specifications. These results are in line with the decreased incentives to shift profits caused by the tax rate change. However, further inspection of the statistical significance of the difference between the estimates from these two years is needed in order to derive precise implications of the tax rate change.

5.4 Endogeneity of tax policy

As discussed in Chapter 4.3, country's tax policy choices may not be exogenous to the reported pretax profits. Therefore, this chapter presents instrumental variable estimates, where tax rate of a country is instrumented by its size. Size of the country on the other hand is proxied by the population of it. As identified before, using population as an instrument for tax rate may not be straightforward because of the possibility of exogeneity condition not being satisfied. However, to compare results to those derived by Hines and Rice (1994), I introduce the results derived with the instrumental variable approach in Table 17. In addition, I present results with using the lagged tax rates as an instrument for tax rate as suggested by Klassen and Laplante (2012). Again, we should consider if the exogeneity restriction of the instrument can be satisfied. Thus, these results should be interpreted with this caveat in mind.

First two columns of Table 17 introduce the regressions done with instrumenting tax rate with population. Columns 3 and 4 in turn instrument tax rate with the lagged levels of tax rates. I employ second to fourth lags of the corporate income tax (CIT) rate as instruments for the tax rate at year t. As discussed in Chapter 4.3, idea of using the lagged tax rates is that the multinational's incentives to shift profits is mostly stable in time and thus, captures the portion of tax rates related to the profit shifting incentives (Klassen and Laplante, 2012). The upper part of Table 17 reports the estimates of the main regressions with using the instrumental variables. Bottom part of the table in turn present results from the first stage regressions. The last row indicates the results of F-tests. Staiger and Stock (1997)

suggest a rule of thumb, where in the case of one instrument variable the F-statistic of that instrument resulting under 10 is a signal of a weak instrument. However, the F-statistics of population in both specifications are notably over 10, suggesting that population fulfills the instrument relevance condition (i.e. they are correlated with the endogenous independent variable, tax rate). In addition, I perform the Sargan-Hansen test of over-identifying restrictions for the regressions with lagged tax rates as instruments. The large p-values suggest that the joint null hypothesis of the instruments being uncorrelated with the error term, cannot be rejected. This on the other hand is a positive signal of the instrument exogeneity.

Beginning with columns 1 and 2 of Table 17, the instrument in use is log of population. Profit before taxation (PBT) is used as the dependent variable in column 1. This specification results with a tax semi-elasticity estimate of -7.2, that is statistically significant at the 10%-level. The coefficient estimate of labor shows a statistical significance at the 1%-level with an estimate of 0.6. Capital input coefficient is estimated to be 0.05, that is statistically significant only at the 10%-level. Productivity in turn does not show a statistically significant estimate. Column 2 on the other hand uses EBIT as the dependent variable. The coefficient estimates and standard errors of capital, labor as well as productivity do not experience notable changes compared to those derived with profit before taxation. The estimated tax incentive in turn is considerably less negative, with a coefficient estimate of -5.9. This estimate is also statistically significant at the 10%-level. We can notice that these semi-elasticity estimates are substantially more negative than those derived without the instrumental variable approach.

Columns 3 and 4 of Table 17 use the lagged tax rates as instruments for tax rate at time t. Following Klassen and Laplante (2012) lags $t-2$, $t-3$ and $t-4$ of the tax rates are used. Column 3 with profit before taxation as the proxy for pretax profits, shows a tax semi-elasticity estimate of -12.2. The estimate is statistically significant at the 1%-level. Labor and capital variable estimates are also statistically significant at the 1%-level with coefficient estimates of 0.5 and 0.05 respectively. Additionally, productivity results with an estimate of 0.5, that is statistically significant at the 10%-level. Column 4 again using EBIT as the dependent variable results with a less negative semi-elasticity estimate of -9.5, that is statistically significant at the 1%-level. Labor shows an estimate of 0.6 that is statistically significant at the 1%-level as well. Estimate of capital shows statistical significance at the 5%-level with a coefficient estimate of 0.05. Again, productivity results at an estimate of 0.4 that has statistical significance only at the 10%-level. The semi-elasticity estimates with lagged values are substantially more negative than the ones derived with normal fixed effects models.

Table 17: Regression outputs with Panel A and instrumental variables

Main regression using instrumental variables				
Dependent variable:	Log PBT	Log EBIT	Log PBT	Log EBIT
	(1)	(2)	(3)	(4)
Tax rate	-7.161*	-5.905*	-12.151***	-9.504***
	(4.037)	(3.534)	(3.667)	(3.22)
Log labor	0.567***	0.572***	0.538***	0.551***
(costs of employees)	(0.08)	(0.081)	(0.078)	(0.079)
Log capital	0.047*	0.047**	0.053***	0.051**
(fixed tangible assets)	(0.025)	(0.023)	(0.025)	(0.023)
Log productivity	0.252	0.26	0.455*	0.407*
(GDP per capita)	(0.242)	(0.216)	(0.245)	(0.214)
Instrument	Log population	Log population	CIT rate lags	CIT rate lags
Fixed effects	Firm	Firm	Firm	Firm
Observations	4,371	4,371	4,371	4,371
Number of affiliates	1,078	1,078	1,078	1,078
R-squared	0.562	0.594	0.501	0.56
First stage regressions of tax rate on instrumental variables and other independet variables				
Dependent variable: tax rate				
Log Population	-0.419***	-0.419***		
	(0.026)	(0.026)		
Lag^2 tax rate			0.38***	0.38***
			(0.021)	(0.021)
Lag^3 tax rate			-0.135***	-0.135***
			(0.014)	(0.014)
Lag^4 tax rate			0.211***	0.211***
			(0.026)	(0.026)
First stage F-statistic	266.33	266.33	277.14	277.14

Notes: Heteroskedasticity robust standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Concluding on Table 17, all semi-elasticity estimates are substantially higher than the estimates of basic fixed effects models. In addition, with both instruments the semi-elasticity with profit before taxation is considerably more negative compared to the regression using EBIT. Actually, both instruments suggest that debt shifting as a channel accounts to about one-fifth of total profit shifting (i.e. semi-elasticity estimates with EBIT are about 80% of the estimates with profit before taxation). Also, capital and labor estimates are quite consistent even between the different instruments whereas the productivity estimate varies more.

6 Discussion

Here I discuss the results introduced in Chapter 5 in more detail here. The main research question of this study was to estimate the scale of profit shifting by Finnish multinationals and to test methods used by previous literature to a setting with Finnish multinationals. All regressions, including the basic results as well as the additional regressions, show a semi-elasticity estimate with a negative sign. This is in line with profit shifting theory and thus, suggests that Finnish multinationals may indeed engage in profit shifting activities as a negative relation between a tax rate increase and profits is identified.

Comparing the results derived with different samples, I obtain the less negative semi-elasticity estimates with Panel A which consists of individual affiliates. The basic results with Panel A, i.e. using profit before taxation as the dependent variable, shows semi-elasticity estimates between -2.1 and -2.9. These suggest that a 10 percentage point increase in the affiliate's home country tax rate is related to a 21-29% decrease in reported profit before taxation in that country. Respective results with Panel B, the affiliates aggregated by ultimate owner at the country level, are between -2.4 and -3.5, i.e. as the tax rate increases by 10 percentage point, a 24-35% decrease in reported profit before taxation is related with the tax rate increase. The more negative estimates may suggest that multinationals tend to shift their profits on the country level more than on the individual level. Compared to the semi-elasticity estimates presented by Huizinga and Laeven (2008) resulting around -1, my results are substantially larger. On the other hand, where I have panel data of individual affiliates, Huizinga and Laeven (2008) only have a cross-sectional data of individual affiliates. Other explanation may be that Finnish multinationals differ from the set of European multinationals used by Huizinga and Laeven (2008).

Turning to the results with the last panel, Panel C that is aggregated at the country level, the semi-elasticity estimates experience even larger growth. The estimates range from -4.8 to -7.4. The initial limitation of estimates on the country level is that firm level fixed effects cannot be controlled for and thus, the results may be biased. On the other hand, these are comparable to the results introduced by Hines and Rice (1994). They find an estimate of -6.3 whilst using net pretax total income as the dependent variable and the standard Hines-Rice estimation approach. Thus, the estimate of Hines and Rice (1994) falls in the same range as my estimates and further confirm the results.

Chapters 5.2, 5.3 and 5.4 provide several additional regressions as robustness checks for my baseline results. Firstly, I present regressions with the alternative pretax profit proxy, EBIT. The purpose is to compare these results to the baseline

results to see how important debt-shifting channel of profit shifting is relative to all channels and additionally test if my chosen pretax profit measure is driving the negative results. Comparing the results of the standard Hines-Rice approaches (i.e. no additional controls included) of Tables 5 and 8, I estimate debt-shifting channel to account to about 21-23% of total profit shifting[17]. Beer et al. (2018) estimated that the debt-shifting channel accounts about one-quarter of the total profit shifting, which is quite comparable to my results.

The comparison between the different pretax profit proxies can also be done with the additional regressions where I provide results with both profit proxies. Firstly, the regression outputs adjusted to per employee level in Table 11 suggest that debt-shifting channel explains roughly 22-23% of total profit shifting. Additionally, Table 17 provides the instrumental variable estimates for both pretax profit proxies. The estimated importance of debt-shifting channel now is about 18% with population as an instrument and 22% with the lagged tax rates. These estimates are somewhat in line with the previous estimates of debt-shifting channel's impact.

I also present the results with profit before taxation and EBIT using different sample restrictions in Table 13. The relative importance of debt-shifting as a channel of profit shifting seems to vary more with the different samples. Sample of only manufacturing affiliates suggest that debt-shifting is less important as a channel, explaining only 15% of total profit shifting. Results with Western European affiliates in turn show that debt-shifting accounts to about 21% of profit shifting activities determined by this estimation approach. Finally, the results with affiliates that are audit clients of Big Four accounting companies suggest a higher importance of debt-shifting as it accounts to 27% of total profit shifting. These estimates suggest that the non-financial channels, like transfer pricing, may play a bigger role in the profit shifting activities of manufacturing affiliates compared to all affiliates. On the other hand, these results imply that Big Four audit clients use debt-shifting channel relatively more to shift their profits compared to all affiliates in general.

The additional regressions with the different samples in Table 13 show also differences in scale of profit in addition to the differences in the importance of debt-shifting channel. The results can be compared to similar regressions without sample restrictions, which are -2.9 and -2.3 for profit before taxation and EBIT respectively. Starting with the sample of only manufacturing affiliates, the tax semi-elasticity estimates of -3.9 and -3.3, suggest that manufacturing affiliates are more engaged in profit shifting activities measured with both profit proxies. Next, the semi-elasticity

[17]Debt-shifting part of total profit shifting is calculated by comparing results of similar regression specifications: 1 − (semi-elasticity estimate with EBIT/semi-elasticity estimate with PBT) = debt-shifting %.

results with Western Europe affiliates are -2.5 and -2. These on the other hand are only slightly less negative than the ones with all affiliates included. Turning to the last sample, Big Four audit clients, estimated semi-elasticities are -3.3 with profit before taxation and -2.4 with EBIT. Whereas the EBIT semi-elasticity estimate is quite similar to the one with all affiliates, -2.3, the profit before taxation estimate is more negative. This again may suggest that affiliates audited by Big Four companies may be more engaged in profit shifting activities, especially shifting through the financial channel.

As the estimation method relies on the assumption that capital and labor input proxies with the productivity level capture the part of profits generated by the affiliate's real activity, these proxies are important for the interpretation of the results. In the baseline regressions capital input is proxied by fixed tangible assets and labor input by costs of employees. Additional regressions provide results also with other proxies to test how sensitive my results are with respect to the input measures. The results of Table 9 using different proxies are similar to my main results, further confirming them. Comparing my estimates of labor input to those provided by Huizinga and Laeven (2008), the labor coefficient estimates are quite similar (often around 0.6). In my results, capital input on the other hand shows usually an estimate of around 0.05. Thus, capital coefficient estimates do not reach the level of roughly 0.2 estimated by Huizinga and Laeven (2008), except in the cross-section regressions where capital show estimates of 0.2. This may arise from the fact that the fixed-effects regression model captures some of the effect of capital input as these fixed tangible assets may not vary from year to year much (as they are fixed assets as the name indicates).

Additionally, Chapter 5.2 provides regressions derived with two sub-samples of the main data: those affiliates that have a lower home country tax rate (low tax affiliates) and those with a higher home country tax rate (high tax affiliates) as compared to Finland. The results show that semi-elasticity estimates are more negative with the low tax affiliates. These suggest that affiliates located in these lower tax countries may react more strongly to tax rate changes as those located in higher tax rate countries. According to the semi-elasticity estimates, a 10 percentage point increase in tax rate is related to 39% decrease in profits of affiliates located in lower tax countries, whereas a similar tax rate increase is associated with only 23-27% decrease in profits of the high tax affiliates. We should notice that the difference between the semi-elasticity estimates is not statistically significant. Interestingly, the difference between the estimates of labor input is statistically significant at the 5%-level and the 95%-confidence interval does not include zero, suggesting that there is a difference between these groups. This difference may imply that the contribution

of labor to profit before taxation seems to be larger in high tax countries. This in turn supports the view that profit shifting destinations (usually low tax countries) also rely less on physical inputs, like employees.

Using average effective tax rates (AETR) as an alternative proxy for the tax incentive of profit shifting shows less negative estimates than with statutory tax rates. The semi-elasticity with AETR is estimated to be -2.3 and -1.7, whereas with statutory CIT rate estimates are -3 and -2.3. Also the results introduced by Godar (2018) show a similar pattern where the regressions derived with statutory tax rate results with a more negative tax semi-elasticity estimate compared to the one with AETR. The difference may arise either from the definition of the AETR in the used data or from the fact that tax haven observations are mostly missing from the sample. These missing tax haven observations on the other hand means that those with low AETR are not in general included in the sample. However, the semi-elasticity estimates are still negative and statistically different from zero, thus further confirming my baseline results.

Lastly, Chapter 5.2 introduces some regressions to test the sample restrictions of the data. Table 14 presents the regressions results derived with a balanced data to test whether using an unbalanced has limitations. The results derived with the balanced data are quite similar to those derived with the original unbalanced data, suggesting that using the unbalanced data should not cause major drawbacks. Additionally, Table 15 provides additional regressions with the modified Panel C to see how the results change once the country level aggregations is done after the negative and zero observations are dropped before aggregation. In other words, the modified Panel C consists of the exactly same observation as Panel A does. Actually, the exact way in which the aggregations are done seems to have a quite large impact. The results with the original Panel C (that is, the aggregation is done before dropping the individual affiliate level zero and negative observations) suggest a semi-elasticity estimate between -4.8 and -7.4 whereas the results with the modified Panel C suggest a semi-elasticity between -2.7 and -3.2. Thus, results with original Panel C seems to overstate the scale of profit shifting compared to the results with modified Panel C. This possibly overstating effect should be taken into account once interpreting the results.

The results of the time comparison introduced in Chapter 5.3, are in line with the decreased incentives for Finnish multinationals to shift their profits in 2017 compared to 2012. However, we cannot make any straightforward implications of the tax rate change as the statistical significance of the difference in the results between the two time periods is not estimated. Additionally, these results only apply to the non-financial channels of profit shifting as the regressions used EBIT as the dependent

variable. On the other hand, regressions produced with profit before taxation as the dependent variable did not result in any semi-elasticity estimates that were statistically different from zero. This fact in turn can result from various reasons. One is that an interest barrier, which is a restriction to interest deductions, was introduced in Finland in 2014 (Finnish Tax Administration, 2014a). This restriction might have a decreasing effect on the usage of debt-shifting as a channel of profit shifting. The changes in the legislation regarding interest deductions may also partly explain why the debt-shifting channel seems to account for a slightly smaller part of total profit shifting as compared to estimates of previous literature.

Turning to the question about tax policy endogeneity, Table 17 provides results derived with the instrumental variable approach. I exploited population and tax rate lags separately as instruments for the tax rate. Keeping in mind that the instruments may not satisfy the instrumental exogeneity assumption, I compare the results to those introduced by Hines and Rice (1994). Using population as the instrument for tax rate, they find an estimate of -13 with net pretax total income as the dependent variable and -3 with pretax non-financial income. Respectively, my estimated semi-elasticities are -7.2 and -5.9. As the results are different, they still fall in the same range. In addition, my results with the lagged tax rates are -12.2 and -9.5. Concluding on these, the semi-elasticity estimates using instrumental variable approach with EBIT seem to be more negative.

All in all, results of this study confirm the results of previous studies as well as the theory of profit shifting where a tax rate increase should reduce the reported pretax profits. Results from the basic regressions with Panel A from Chapter 5 vary from -2.1 to -2.9. In other words, if the affiliate's home country tax rate decreases by 10 percentage points and tax rate of the parent remains equal (i.e. the tax differential increases), the reported pretax profit should increase by 21-29%. I provide additional regressions using different proxies as well as sample restrictions. These additional regressions further confirm my results as all of them result with negative semi-elasticity estimates. Estimates range from -1.7 to -3.9 with profit before taxation as the proxy for pretax profits. Comparably, the statistically significant results with EBIT range from -1.6 to -3.3. These ranges exclude the instrumental variable as well as cross-section regressions as they are not as comparable to the baseline results. Appendix A.5 summarizes the semi-elasticity estimates derived with the standard Hines-Rice approach used in Chapters 5.1 and 5.2 in order for the reader to easily conclude on the results.

7 Conclusions

Profit shifting is a largely acknowledged problem that has many adverse effects. As indicated by the extensive previous literature, there are many results suggesting that multinationals indeed engage in profit shifting activities. The scale as well as the relative importance of channels through which profits are shifted are still under debate. The phenomenon as well as its channels are quite difficult to study as the problem is complex. In addition, profit shifting is an international question and therefore, all international as well as domestic tax laws and business cycles have their impact on it. Distinguishing all of these in a credible way may be impossible. However, this study aims to evaluate the profit shifting behavior of Finnish multinationals by exploiting a model used by several previous studies.

Results of this study confirm those of previous literature. Theory of profit shifting suggests that as the home country tax rate of an affiliate increases, this should be related with decreased reported pretax profits. The regression results show this negative relation, described by the negative tax semi-elasticity estimate. Results derived with the fixed effects model using individual affiliate level data suggest that the tax semi-elasticity estimate concerning Finnish multinationals is between -2.1 and -2.9. These semi-elasticity estimates in turn imply that a 10 percentage point increase in affiliate's home country tax rate (for example a tax rate change from 20% to 30%) is associated with decreased reported profit before taxation of about 21-29%. The results are statistically and economically significant. Additionally, the estimates are more negative than for example the consensus semi-elasticity estimate of 0.8 provided by Heckemeyer and Overesch (2017).

Furthermore, the results I have introduced here suggest that debt-shifting channel accounts to about one-fifth of total profit shifting. I derive this estimate by comparing the semi-elasticity estimates of regressions using EBIT as dependent variable to those using profit before taxation as dependent variable. The intuition is that as EBIT captures profit shifting done through non-financial channels, profit before taxation captures profit shifting done through all channels (including also the financial channel, debt-shifting). The estimate of debt-shifting accounting for one-fifth is slightly smaller, compared to the estimates introduced by Beer et al. (2018) that suggest debt-shifting to account for one-quarter of total profit shifting. In addition, results derived with only manufacturing affiliates included suggest an even smaller importance of debt-shifting as a channel of profit shifting. This may imply that non-financial channels, like transfer pricing, are more important to manufacturing firms as mechanisms to shift their profits in response to tax rate differentials.

Concluding on some macro implications of the results is important in order to further motivate the research question. Imagining a situation where Finland would increase its tax rate by 5 percentage points (i.e. from 20% to 25% for example) while the home country tax rates of affiliates would remain equal. With the semi-elasticity estimates between -2.1 and -2.9, the tax rate increase of Finland would be associated with the multinational affiliates increasing the reported pretax profits in the foreign countries by 10.5-14.5%. This in turn implies that reported pretax profits of Finland-based multinational parents would decrease. In order to derive a specific estimate of tax revenue estimates, we would need more information on the profits reported by Finnish multinationals.

Future research would ideally exploit data on all multinational affiliates, also those located in tax haven countries. Studying also profit shifting of foreign firms in Finland (i.e. parents of the affiliates are foreign) would be a beneficial addition to this study, which has focused only on foreign affiliates of Finnish multinationals. This way, we could more credible evaluate whether there is more of inward or outward profit shifting from Finland (i.e. whether Finland is a winner or loser in terms of tax revenue reallocation). Studying the profit shifting behavior of multinationals is important in order to design effective preventive policies. Especially, identifying the mechanisms used by multinationals to shift their profits to low tax country is necessary if we want to prevent profit shifting. Therefore, future studies should examine which mechanisms are in use and how multinationals substitute between these mechanisms if the costs of one of them rise. Identifying and exploring ways to study for example transfer pricing and strategic locating of intellectual property could then help to prevent profit shifting through these by designing policies that raise the costs of using these channels.

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Glossary

active income

Income of a business generated by its true business (selling products and/or services).

arm's length principle

Condition stating that the price of an inter-company transaction should replicate the price of a transaction to a third independent party.

controlled foreign company (CFC) rules

CFC rules are applied to prevent using offshore low tax affiliates to avoid high taxes. Implemented by individual countries and thus, are not standardized globally.

credit method

Applied in order to avoid double taxation. Residence country permits foreign tax credit in response to foreign tax payments to offset the local residence country tax payments.

deferral method

Resource based tax liabilities of foreign income is payable only once the income is repatriated to the parent based in the residence country.

deficit foreign credit

Generated in situations of credit method where foreign taxes paid of income are smaller than the residence country tax liability of the foreign income. Firm needs to pay taxes to the residence country if deficit foreign credit occurs.

exemption method

Applied in order to avoid double taxation. Residence country does not apply taxes to the foreign income.

excess foreign credit

Generated in situations of credit method where foreign taxes paid of income exceed the residence country tax liability of the foreign income.

passive income

Income from generated from other sources than real activity (for example investments).

permanent establishment (PE)

Fixed place from where a firm conducts some or all of its business operations. PE usually causes income and/or value added tax liability to a country.

residence country

Place where the firm receiving income is located at.

source country

Place where the investment or production of a firm occurs.

separate accounting

Each affiliate operating in different countries of a multinational is taxed on the affiliate level (i.e. taxing is not done on the entire multinational corporate group level).

territorial system

Tax system where only active income generated within the country's borders is taxed by the country. These countries exempt foreign earnings whilst being a residence country.

worldwide system

Under the system residence country has the right to tax all active income of a firm, including active income generated outside the country's borders.

A Appendix

A.1 Grouping of countries within sample

Table 18: Grouping of countries within the sample

Tax havens	**EU members**	**Developing countries**	**Western Europe**
Big havens	Austria	*2018 listing*	Austria
Ireland	Belgium	Bosnia and Herzegovina	Belgium
Singapore	Bulgaria	Bulgaria	France
Small havens	Croatia	China	Germany
Luxembourg	Czech Republic	Colombia	Iceland
	Estonia	Croatia	Ireland
	France	India	Italy
	Germany	North Macedonia	Luxembourg
	Greece	Poland	Netherlands
	Hungary	Romania	Norway
	Ireland	Russia	Portugal
	Italy	Serbia	Spain
	Latvia	Thailand	Sweden
	Lithuania	Turkey	United Kingdom
	Luxembourg	Ukraine	
	Netherlands	*2012 listing*[1]	
	Poland	Latvia	
	Portugal	Lithuania	
	Romania		
	Slovakia		
	Slovenia		
	Spain		
	Sweden		
	United Kingdom		

Sources: Tax havens: Hines and Rice (1994); EU members: European Union (2019); Developing countries: IMF World Economic Outlook Database (2014; 2015; 2018); Western Europe: UCLA Center for European and Russian Studies (2019)

Notes: [1]Latvia considered as a developing country before 2014, Lithuania before 2015.

A.2 Variable definitions and data sources

Table 19: Variable definitions and data sources

Variable	Definition	Source
Tax variable		
Statutory tax rate	Corporate tax rate of the country (between 0 and 1) for years 2012-2017.	KPMG
Average effective tax rate (AETR)	Weighted average of country's finance- and asset-specific AETR's for 2017 (between 0 and 1).	OECD
Pretax profit		
Earnings before interest and taxes (EBIT)	Operating profit (or loss), calculated by deducting other operating expenses from the gross profit.	Orbis
Profit (or loss) before taxation	Profit before extraordinary items and tax. Calculated by adding financial profit (financial revenue minus financial expense) to EBIT.	Orbis
Labor input		
Number of employees	Number of employees.	Orbis
Costs of employees	Personnel expenses and social security expenses.	Orbis
Capital input		
Fixed assets	Includes intangible, tangible and other fixed assets.	Orbis
Fixed tangible assets	Includes only tangible fixed assets.	Orbis
Total assets	Total assets includes fixed assets and current fixed assets (stocks, debtors, other current assets and cash & cash equivalent).	Orbis
Productivity		
GDP per capita	GDP per capita current USD (exchanged to EUR with rate 0.8916).	World Bank Development Indicators

Instrumental variable		
Population	Total population of a country.	World Bank Development Indicators
Other control variables		
Operating revenue (turnover)	Company's revenue generated from primary business activities.	Orbis
Debt ratio	Ratio of total debt to total assets.	Orbis
NACE code	The NACE code system is the European statistical classification of economic activities with a hierarchical structure with 4 levels. The second level, 2-digit sector code, is used.	Orbis
Big Four auditor	Indicates if the current auditor of the affiliate is a Big Four company (KPMG, EY, PwC or Deloitte).	Orbis

A.3 Tax rates 2012-2017 in sample countries

Table 20: CIT rates 2012-2017 and AETR 2017

Country	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Average**	**AETR 2017**[1]
Australia	30	30	30	30	30	30	30	31.39
Austria	25	25	25	25	25	25	25	23.68
Belgium	33.99	33.99	33.99	33.99	33.99	33.99	33.99	25.99
Bosnia and Herzegovina	10	10	10	10	10	10	10	-
Bulgaria	10	10	10	10	10	10	10	9.15
China	25	25	25	25	25	25	25	23.58
Colombia	33	25	25	25	25	34	27.83	-
Croatia	20	20	20	20	20	20	20	15.63
Czech Republic	19	19	19	19	19	19	19	20.6

Estonia	21	21	21	20	20	20	20.50	17
Finland	24.50	24.50	20	20	20	20	21.50	18.98
France	33.33	33.33	33.33	33.33	33.33	33.33	33.33	32.97
Germany	29.48	29.55	29.58	29.72	29.72	29.79	29.64	27.3
Greece	20	26	26	29	29	29	26.50	27.63
Hungary	19	19	19	19	19	9	17.33	9.93
Iceland	20	20	20	20	20	20	20	18.81
India	32.45	33.99	33.99	34.61	34.61	34.61	34.04	44.14
Ireland	12.50	12.50	12.50	12.50	12.50	12.50	12.50	11.84
Italy	31.40	31.40	31.40	31.40	31.40	24	30.17	22.06
Japan	38.01	38.01	35.64	33.86	30.86	30.86	34.54	27.48
Korea	24.20	24.20	24.20	24.20	24.20	22	23.83	21.99
Latvia	15	15	15	15	15	15	15	13.5
Lithuania	15	15	15	15	15	15	15	13.32
Luxembourg	28.80	29.22	29.22	29.22	29.22	27.08	28.79	24.5
Malaysia	25	25	25	24	24	24	24.50	-
Netherlands	25	25	25	25	25	25	25	22.97
New Zealand	28	28	28	28	28	28	28	26.78
North Macedonia	10	10	10	10	10	10	10	-
Norway	28	28	27	27	25	24	26.50	23.13
Poland	19	19	19	19	19	19	19	17.62
Portugal	25	25	23	21	21	21	22.67	27.52
Romania	16	16	16	16	16	16	16	14.53
Russia	20	20	20	20	20	20	20	18.79
Serbia	10	15	15	15	15	15	14.17	-
Singapore	17	17	17	17	17	17	17	16.17
Slovakia	19	23	22	22	22	21	21.50	21.79
Slovenia	18	17	17	17	17	19	17.50	17.93
Spain	30	30	30	28	25	25	28	24.84
Sweden	26.30	22	22	22	22	22	22.72	19.79
Thailand	23	20	20	20	20	20	20.50	21.53

Turkey	20	20	20	20	20	20	20	20.19
Ukraine	21	19	18	18	18	18	18.67	-
UK	24	23	21	20	20	19	21.17	19.04
USA	40	40	40	40	40	40	40	37.51
Average	23.07	23.02	22.70	22.59	22.40	22.09	22.65	21.88

Sources: Corporate tax rates: KPMG Corporate tax rates table (n.d.); Average effective tax rates (AETR): OECD Tax Database (2018).

Notes: [1] AETRs for 2017 not available for all sample countries.

A.4 Distribution of sample affiliates by countries

Table 21: Distribution of sample affiliates by countries

Country	**Number of affiliates**	**Share**
Australia	9	0.46%
Austria	16	0.82%
Belgium	26	1.33%
Bosnia and Herzegovina	1	0.05%
Bulgaria	7	0.36%
China	18	0.92%
Colombia	3	0.15%
Croatia	7	0.36%
Czech Republic	26	1.33%
Estonia	507	25.99%
France	51	2.61%
Germany	34	1.74%
Greece	2	0.10%
Hungary	21	1.08%
Iceland	1	0.05%
India	6	0.31%
Ireland	9	0.46%
Italy	55	2.82%
Japan	1	0.05%

Korea	9	0.46%
Latvia	81	4.15%
Lithuania	36	1.85%
Luxembourg	1	0.05%
Malaysia	7	0.36%
Netherlands	10	0.51%
New Zealand	3	0.15%
North Macedonia	1	0.05%
Norway	144	7.38%
Poland	66	3.38%
Portugal	12	0.62%
Romania	23	1.18%
Russia	219	11.23%
Serbia	2	0.10%
Singapore	1	0.05%
Slovakia	18	0.92%
Slovenia	8	0.41%
Spain	34	1.74%
Sweden	351	17.99%
Thailand	8	0.41%
Turkey	2	0.10%
Ukraine	25	1.28%
United Kingdom	89	4.56%
United States of America	1	0.05%
Total	1951	100.00%

A.5 Summary of semi-elasticity estimates

Table 22: Summary of results from Chapters 5.1 and 5.2

Profit proxy	**Table**	**Column**	**Panel**[1]	**Semi-elasticity**
PBT	5	2	A	-2.9***
PBT	6	2	B	-3.5***
PBT	7	2	C	-7.4**
PBT	7	4	C	-5.5**
PBT	9	2	A	-2.2**
PBT	9	3	A	-3.3***
PBT	9	4	A	-2.2**
PBT	9	5	A	-2.6**
PBT	9	6	A	-2.1*
PBT[2]	11	2	A	-2.2**
PBT	12	2	A (low tax affiliates)	-3.9**
PBT	12	4	A (high tax affiliates)	-2.7**
PBT	13	1	A (manufacturing affiliates)	-3.9**
PBT	13	2	A (Western Europe affiliates)	-2.5**
PBT	13	3	A (Big Four audit clients)	-3.3**
PBT	14	2	A (balanced)	-2.6**
PBT	15	2	C (modified)	-2.7*
PBT	15	4	C (modified)	-3.2*
EBIT	8	2	A	-2.3**
EBIT[2]	11	4	A	-1.7*
EBIT	13	4	A (manufacturing affiliates)	-3.3*
EBIT	13	5	A (Western Europe affiliates)	-2.0*
EBIT	13	6	A (Big Four audit clients)	-2.4*

Notes: Semi-elasticity estimates are from basic Hines-Rice regression (productivity variable is included but no additional controls are included). [1] additional sample restrictions are in parantheses. [2] profit measures adjusted to per employee level. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.